

3rd EDITION



KENWOOD

SERVICE MANUAL

**TR-2400 ST-1, BC-5
SC-3, PB-24**

SC-3: EXCEPT U.S.A MARKET

2m FM SYNTHESIZED HAND-HELD TRANSCEIVER

SPECIFICATIONS

[K type]

GENERAL

Semiconductors	Transistors	28
	FET	1
	ICs	16
	Diodes	50
Display	LCD (Liquid Crystal Display)	
Frequency Range	144.00 to 147.995 MHz	
Frequency Synthesizer	Digital control of phase locked VCO	
Synthesizer Stability	Less than ± 750 Hz at 25°C	
Mode	FM	
Channels	800	
Memory Channels	10	
Operating Temperature	-20 to 50°C	
Power Voltage	9.6V DC $\pm 15\%$	
Grounding	Negative grounding	
Antenna Impedance	50 Ω	
DC Current	Approx. 30 mA in receive with no input signal	
	Approx. 500 mA in transmit (at 1.5 W RF output)	
	Approx. 2 mA in memory backup with power switch off	
Dimensions	71 mm (2-13/16") wide	
	192 mm (7-9/16") high	
	47 mm (1-7/8") deep	
Weight	740 gr (1.62 lbs.)	

TRANSMITTER SECTION

RF Output Power	1.5 Watts
Modulation	Variable reactance direct shift
Max. Frequency Deviation	± 5 kHz
Spurious Radiation	Less than -60 dB
Microphone	Condenser microphone

RECEIVER SECTION

Circuitry	Double superheterodyne
Intermediate Frequency	1st IF.....10.7 MHz
	2nd IF.....455 kHz
Sensitivity	Less than 0.2 μ V for 12 dB SINAD (Less than 1 μ V for 30 dB S/N)
Squelch Sensitivity	Less than 0.25 μ V
Pass Band Width	More than 12 kHz at 6 dB down
Audio Output	More than 200 m watts across 8 Ω load (10% distortion)

NOTE: Circuit and ratings may change without notice due to developments in technology.

[W, T type]

GENERAL

Semiconductors	Transistors	28 (W), 29 (T)
	FET	1
	ICs	16
	Diodes	50
Display	LCD (Liquid Crystal Display)	
Frequency Range	144.00 to 145.995 MHz	
Frequency Synthesizer	Digital control of phase locked VCO	
Synthesizer Stability	Less than ± 750 Hz at 25°C	
Mode	FM	
Channels	400	
Memory Channels	10	
Operating Temperature	-20 to 50°C	
Power Voltage	9.6V DC $\pm 15\%$	
Grounding	Negative grounding	
Antenna Impedance	50 Ω	
DC Current	Approx. 30 mA in receive with no input signal	
	Approx. 500 mA in transmit (at 1.5 W RF output)	
	Approx. 2 mA in memory backup with power switch off	
Dimensions	71 mm (2-13/16") wide	
	192 mm (7-9/16") high	
	47 mm (1-7/8") deep	
Weight	740 gr (1.62 lbs.)	

TRANSMITTER SECTION

RF Output Power	1.5 Watts
Modulation	Variable reactance direct shift
Max. Frequency Deviation	± 5 kHz
Spurious Radiation	Less than -60 dB
Microphone	Condenser microphone

RECEIVER SECTION

Circuitry	Double superheterodyne
Intermediate Frequency	1st IF.....10.7 MHz
	2nd IF.....455 kHz
Sensitivity	Less than 0.2 μ V for 12 dB SINAD (Less than 1 μ V for 30 dB S/N)
Squelch Sensitivity	Less than 0.25 μ V
Pass Band Width	More than 12 kHz at 6 dB down
Audio Output	More than 200 m watts across 8 Ω load (10% distortion)

CONTENTS

SPECIFICATIONS	Front Cover	LEVEL DIAGRAM	23
CIRCUIT DESCRIPTION	2	ADJUSTMENT	23
SEMICONDUCTOR/FILTER DATA	3,22	WIRING DIAGRAM	27
PRINTED CIRCUIT BOARD	6	SCHEMATIC DIAGRAM	28
PARTS LIST	13	ST-1	36
PACKING	20	BC-5	37
DISASSEMBLY	21	BLOCK DIAGRAM	Back Cover

CIRCUIT DESCRIPTION

RECEIVING UNIT

The receiving unit employs a double superheterodyne circuit with 3 hybrid IC's. The RF stage is tuned by variable capacitance diodes. The receive signal is RF amplified by Q1 and mixed with VCO outlet by Q2 to produce an IF signal at 10.7 MHz. This signal passes through a Monolithic Crystal filter and is fed to Q4 a hybrid IC containing at the 2nd oscillator and 2nd mixer. Output is the 2nd IF signal 455 kHz. The IF signal is amplified by Q5 a hybrid and becomes an AF signal through the ceramic discriminator. In the receive mode, standby current is about 35 mA, squelch closed (no signal).

Transmitting Unit

The transmitter is a simple 3-stage circuit using direct modulation of the VCO operating at the signal transmit frequency. Since this circuit has no MIXER stage, excellent transmit signal characteristics are obtained.

Operating time:

Normal operating time of TR-2400 is 2 hours and 30 minutes for 1 minute transmission and 3 minutes reception. Fig. 1 shows the voltage/power versus time characteristics.

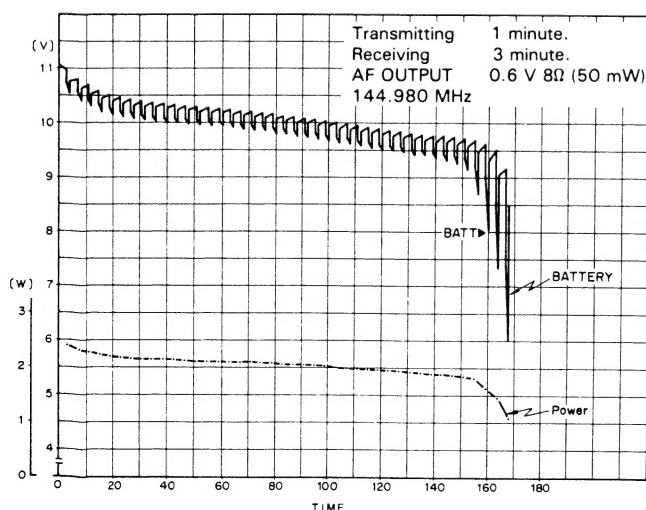


Fig. 1 Voltage/Power vs time

PLL CONTROL UNIT (X50-1640-XX)

Fig. 2 shows the PLL unit. An important feature of the PLL circuit is that the VCO output frequency during transmission operates between 144.00~147.99 MHz. This directly feeds the driver and PA sections. In the receive mode, the VCO frequency operates between 133.3~137.29 MHz. Thus, the VCO output in transmit mode is different from that in receive mode. This PLL unit is compact and its current consumption is very low.

Individual local oscillator triplet circuits are used for transmission and reception. The local oscillator output frequency for transmission is 138.5 MHz and for reception is

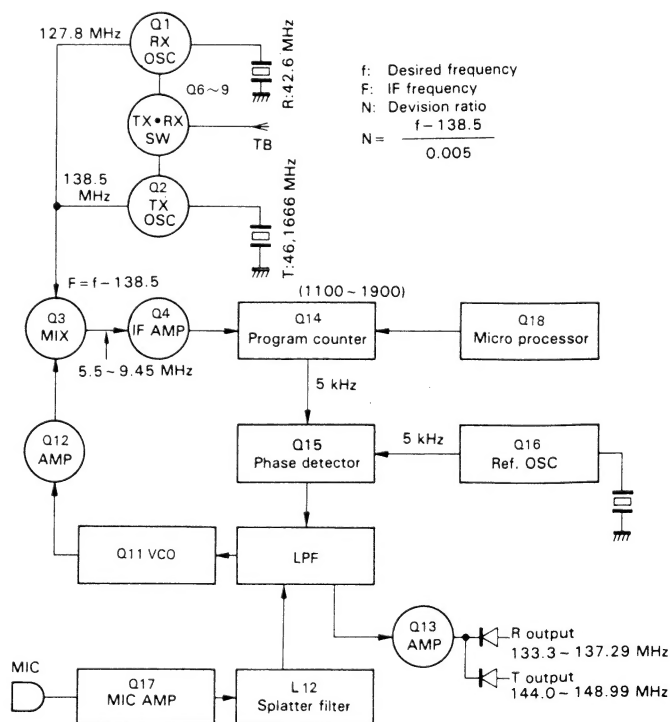


Fig. 2 PLL unit (X50-1640-XX)

CIRCUIT DESCRIPTION

127.8 MHz. The VCO output is amplified by Q12. This circuit has a variable tuning circuit which varies the transmit and receive bandpass by 10.7 MHz.

The output mixed by Q3 is an IF signal of 5.5~9.45 MHz which is fed to a low-pass filter and is amplified by Q4. This signal is then applied to the programmable divider.

The programmable divider is controlled by a micro-processor. the signal is frequency divided by the program counter (frequency division: 1100~1900) to obtain the output frequency in 5 kHz steps. The 10.240 MHz signal from the reference oscillator is compared with the reference frequency (5 kHz) by the phase comparator Q15 and its output is applied through a low-pass filter to the VCO.

The VCO is an FET oscillator circuit. The vari-cap diode D3 (1S2208) is used for controlling frequencies. D5 (1SV50S) for modulation, and D4 (1S2588) for switching transmit and receive modes.

For direct modulation of the VCO, a sharp splatter filter is used after the MIC amplifier. A condenser microphone assures good sensitivity and high quality tone. The control unit is composed of a 4-bit micro-processor having both the frequency control and memory functions required for the TR-2400. The micro-processor is C MOS. and employs a 500 kHz ceramic element as the clock oscillator. Current drain for memory backup is about 2mA. The microprocessor is controlled by a 16 key (4×4) pad to provide fre-

quency selection, UP/DOWN channel selection, memory channel and memory scan channel selection.

DISPLAY UNIT

The display unit is composed of an oscillator (Q2), LCD driver unit, and display driver unit as shown. The LCD is lighted by a 36 Hz oscillator pulse. This pulse is delivered to the LCD backplane.

The display BCD code and digit output from the micro-processor are latched by the LCD drivers Q3~6 (TC4243BP) to produce output for lighting the LCD. This output is simultaneously delivered at the 36 Hz pulse rate to the LCD backplane with a 180° phase difference.

The 36 Hz pulse is also applied to Q1 (TC4030BP), thereby lighting the display lamps for transmission, battery alarm and MR. Q2 (TC4011BP) is the 36 Hz oscillator.

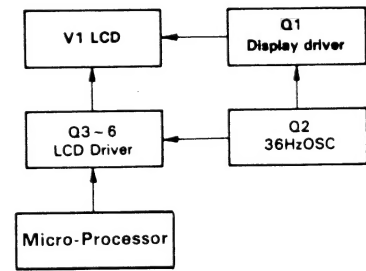


Fig. 3 Display unit

SEMICONDUCTOR DATA

H8D1154E (TX.RX unit Q4) 2ND MIX

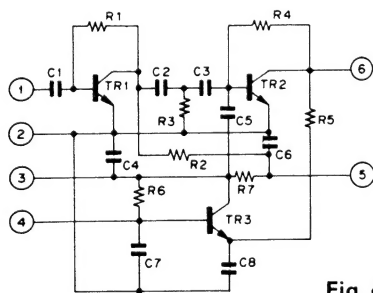


Fig. 4

H8D1252 (TX.RX unit Q6) AMP

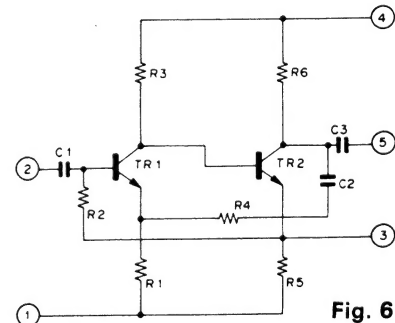


Fig. 6

H8D1152E (TX.RX unit Q5) IF

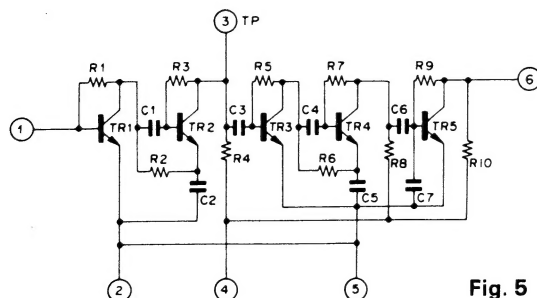


Fig. 5

Monolithic filter L71-0217-05 (TX•RX unit L24)

Item	Rating
Nominal center frequency (f_0)	10.7 MHz
Pass bandwidth	$f_0 \pm 7.5$ kHz or more at 3 dB
Attenuation bandwidth	$f_0 \pm 25$ kHz or less at 18 dB
Ripple	0.5 dB or less
Insertion loss	2.0 dB or less
Guaranteed attenuation	30 dB or more within $f_0 \pm 1$ MHz Spurious; 18 dB or more
Terminal impedance	3 k Ω //2 pF

SEMICONDUCTOR DATA

M51182L
(TX•RX unit Q9) AF PA

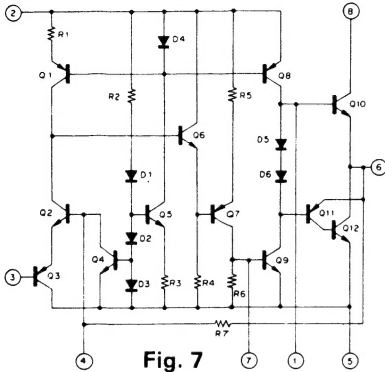


Fig. 7

2SC 2329 (TX•RX unit Q13)

Usage	High-Frequency power amplifier	
Type	NPN epitaxial silicon transistor	
Collector voltage	V _{ceo}	38 V
Emitter voltage	V _{ebo}	3.0 V
Collector-emitter voltage	V _{ceo}	18 V
Collector current	I _c	0.75 mA
Total loss	P _t (T _c = 25°C)	7.5 W (R _{th(j-c)} = 20°C/W)
Junction temperature	T _j	175°C
Storage temperature	T _{stg}	-65 ~ +175°C

Ceramic filter L72-0318-05
(TX•RX unit L9)

Item	Rating
Nominal center frequency	455 kHz
3 dB bandwidth	± 4.2 kHz or more
6 dB bandwidth	± 6 kHz or more
60 dB bandwidth	± 12 kHz or less
Guaranteed attenuation (within ± 100kHz)	50 dB or more
Spurious (within 0.1 ~ 1 MHz)	25 dB or more
Ripple (within ± 4.2 KHz)	3 dB or less
Insertion loss	6 dB or less
Input impedance	2.0 kΩ

MK5087 (N) (PLL unit Q12 or Q21 K type only)
TONE ENCODER

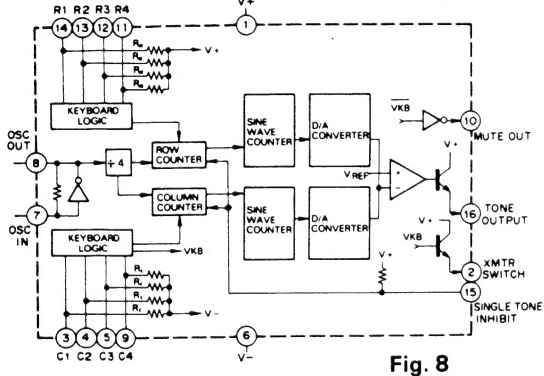


Fig. 8

Monolithic filter L71-0226-05 (TX-RX unit L24)

Item	Rating
Nominal center frequency (f ₀)	10.7 MHz
Pass bandwidth	f ₀ ± 7.5 kHz or more at 3 dB
Attenuation bandwidth	f ₀ ± 25 kHz or less at 40 dB f ₀ ± 45 kHz or less at 60 dB
Ripple	1.0 dB or less
Insertion loss	1.5 dB or less
Guaranteed attenuation	70 dB or more within f ₀ ± 1MHz. Spurious: 40 dB or more at f ₀ ~ f ₀ + 500 kHz. 80 dB or more at f ₀ - (910kHz ± 10kHz).
Terminal impedance	3kΩ

TC5081P (PLL unit Q15 or Q21) Phase detector TC5081P (PLL unit Q15 or Q21) Timing Chart

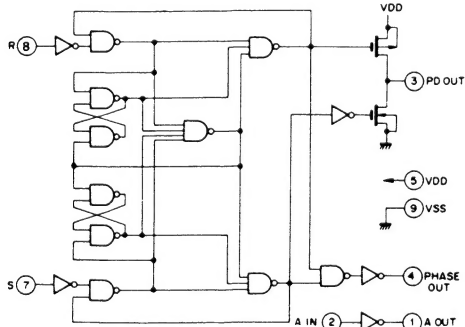


Fig. 10

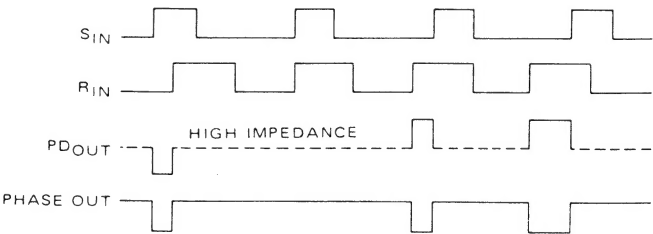


Fig. 11

TC9122P (PLL unit Q14 or Q20) Program counter
Function explanation

Symbol	Name	Content and operation	Remarks
Pin	Programmable counter input terminal	Programmable counter input terminal to which the signal to be divided is input	Build-in bias circuit
Pout	Programmable counter output terminal	Programmable counter output terminal. Output is 1/N of the input frequency. The output pulse width equals 5 bit of the input.	
A ₁ ~ A ₄ B ₁ ~ B ₄ C ₁ ~ C ₄ D ₁ ~ D ₄	× 1 × 10 Program input terminals × 100 × 1000	Terminal to set the dividing ratio. The following input combination is prohibited: A ₁ A ₂ A ₃ A ₄ B ₁ B ₂ B ₃ B ₄ C ₁ C ₂ C ₃ C ₄ D ₁ D ₂ 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Build-in pull-down resistor

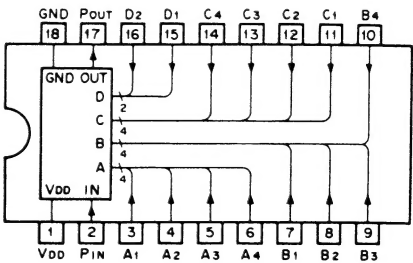


Fig. 12

SEMICONDUCTOR DATA

TC4543BP (DISPLAY unit Q3~6)

Truth table

INPUT							OUTPUT							DISPLAY
LD	BI	PHASE	A	B	C	D	a	b	c	d	e	f	g	
•	H	H	•	•	•	•	H	H	H	H	H	H	H	BLANK
•	H	L	•	•	•	•	L	L	L	L	L	L	L	BLANK
L	L	H	•	•	•	•	LATCH							0
L	L	L	•	•	•	•	LATCH							
H	L	H	L	L	L	L	L	L	L	L	L	L	H	1
H	L	H	H	L	L	L	L	L	L	H	L	H	H	2
H	L	H	L	H	L	L	L	L	L	L	H	H	L	3
H	L	H	L	L	H	L	L	L	L	H	H	L	L	4
H	L	H	H	L	H	L	L	L	H	L	L	H	L	5
H	L	H	L	H	H	L	L	L	H	L	L	L	L	6
H	L	H	H	H	H	L	L	L	L	H	H	H	H	7
H	L	H	L	L	L	H	L	L	L	L	L	L	L	8
H	L	H	H	L	L	H	L	L	L	L	H	L	L	9
H	L	H	L	H	L	H	H	H	H	H	H	H	H	BLANK
H	L	H	H	H	L	H	H	H	H	H	H	H	H	BLANK
H	L	H	L	L	H	H	H	H	H	H	H	H	H	BLANK
H	L	H	H	L	H	H	H	H	H	H	H	H	H	BLANK
H	L	H	H	H	H	H	H	H	H	H	H	H	H	BLANK
H	L	L	L	L	L	L	L	H	H	H	H	H	L	0
H	L	L	H	L	L	L	L	H	H	L	L	L	L	1
H	L	L	L	H	L	L	L	H	H	L	H	L	H	2
H	L	L	L	L	L	L	L	H	H	L	L	L	H	3
H	L	L	L	L	H	L	L	H	H	L	L	H	H	4
H	L	L	L	H	L	L	H	L	H	L	L	H	H	5
H	L	L	L	L	H	H	L	L	H	H	H	H	H	6
H	L	L	L	H	H	L	L	H	H	L	L	L	L	7
H	L	L	L	L	L	L	H	H	H	H	L	H	H	8
H	L	L	L	L	L	L	H	H	H	L	L	H	H	9
H	L	L	L	H	L	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	H	L	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	L	L	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	L	L	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	L	H	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	H	H	H	L	L	L	L	L	L	L	BLANK
H	L	L	L	H	H	H	L	L	L	L	L	L	L	BLANK

• Don't care.

* Don't care.

 7 SEGMENT DISPLAY

Display indicator mode

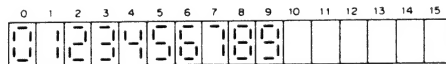
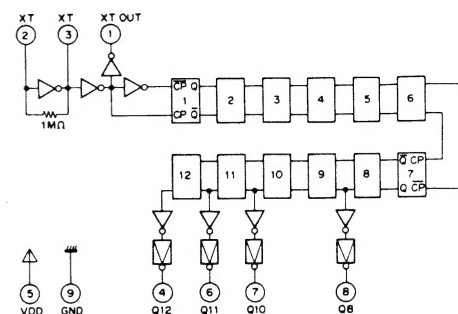


Fig. 15

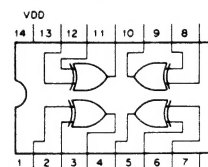
TC5082P (PLL unit Q16 or Q22) OSC, DEV.



PIN NO	8	7	6	4	1
PIN NAME	Q8	Q10	Q11	Q12	XTout
Dividing ratio	1/256	1/1024	1/2048	1/4096	1/1
Output frequency X-tal 10.24 MHz	40 kHz	10 kHz	5 kHz	2.5 kHz	10.24 MHz

Fig. 13

TC4030BP (DISPLAY unit Q1)



Truth table

INPUTS		OUTPUTS
A	B	X
L	L	L
L	H	H
H	L	H
H	H	L

Fig. 14

μPD651C-013 Terminal function (PLL unit X50-1640-XX, Q25)

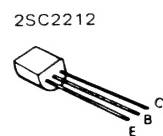
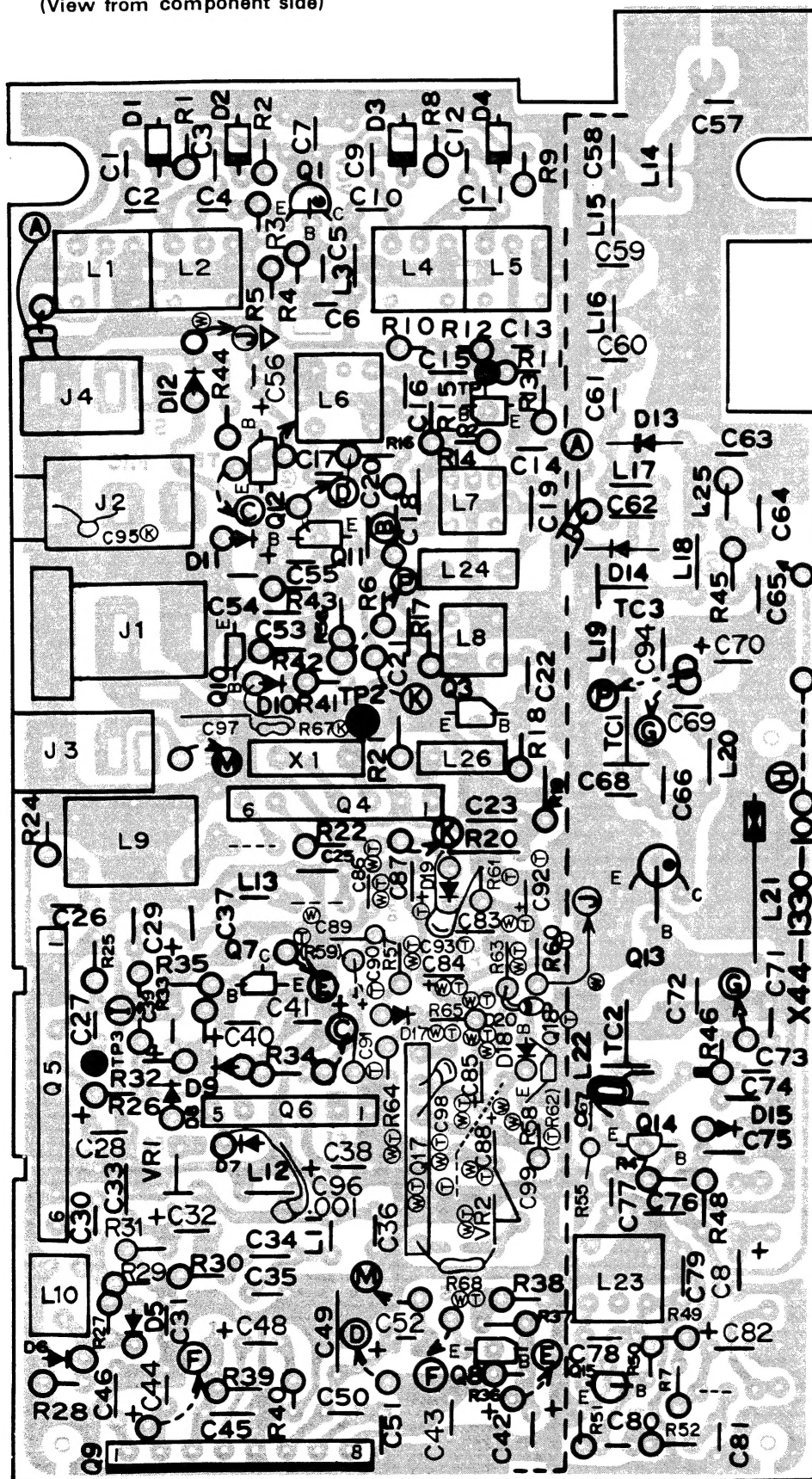
Pin No.	Terminal Name	Input signal	Output signal	Description
1	CL1			
2	PC0		○	X100 program data output
3	PC1		○	X100 program data output
4	PC2		○	X100 program data output
5	PC3		○	X100 program data output
6	INT	○		H when receiving L when transmitting or back-up
7	RES	○		Normally (without operating the keyboard) L
8	PD0		○	X10 Program data output
9	PD1		○	X10 Program data output
10	PD2		○	X10 Program data output
11	PD3		○	X10 Program data output
12	PE0		○	X1 Program data output
13	PE1		○	X1 Program data output
14	PE2		○	X1 Program data output
15	PE3		○	X1 Program data output
16	PFO		○	Indication BCD output
17	PF1		○	Indication BCD output
18	PF2		○	Indication BCD output
19	PF3		○	Indication BCD output
20	TEST	○		5V Power supply
21	VCC	○		5V Power supply

Pin No.	Terminal Name	Input signal	Output signal	Description
22	PG0		○	Keyboard output
23	PG1		○	Keyboard output
24	PG2		○	Keyboard output
25	PG3		○	Keyboard output
26	PH0		○	Indication digit output
27	PH1		○	Indication digit output
28	PH2		○	Indication digit output
29	PH3		○	Indication digit output
30	PI0		○	
31	PI1		○	Pulse output at MR output
32	PI2		○	Vacant terminal
33	PA0	○		Always H (K)
34	PA1	○		Always H (K)
35	PA2	○		L when receiving H when transmitting
36	PA3	○		Squelch Suppression input, Stops at L
37	PB0	○		Keyboard input
38	PB1	○		Keyboard input
39	PB2	○		Keyboard input
40	PB3	○		Keyboard input
41	VSS			Ground
42	CLO			Oscillation output 397kHz

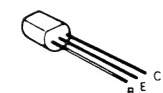
TR-2400

PRINTED CIRCUIT BOARD

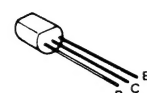
▼ TX-RX unit (X44-1330-XX) XX: 10 (K), 51 (T), 61 (W)
from S/N 006XXXX ~ 010XXXX
(View from component side)



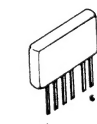
2SC2212



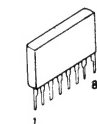
2SC2026



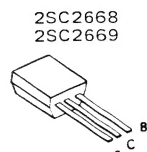
2SC2053



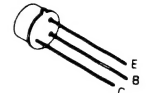
H8D1154E



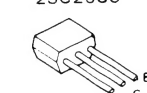
M51182L



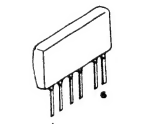
2SC2668
2SC2669



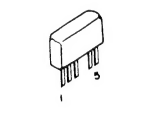
2SC2329



2SA1115E
2SC2603



H8D1152E



H8D1252

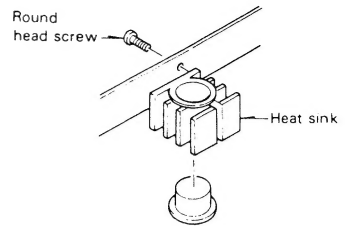
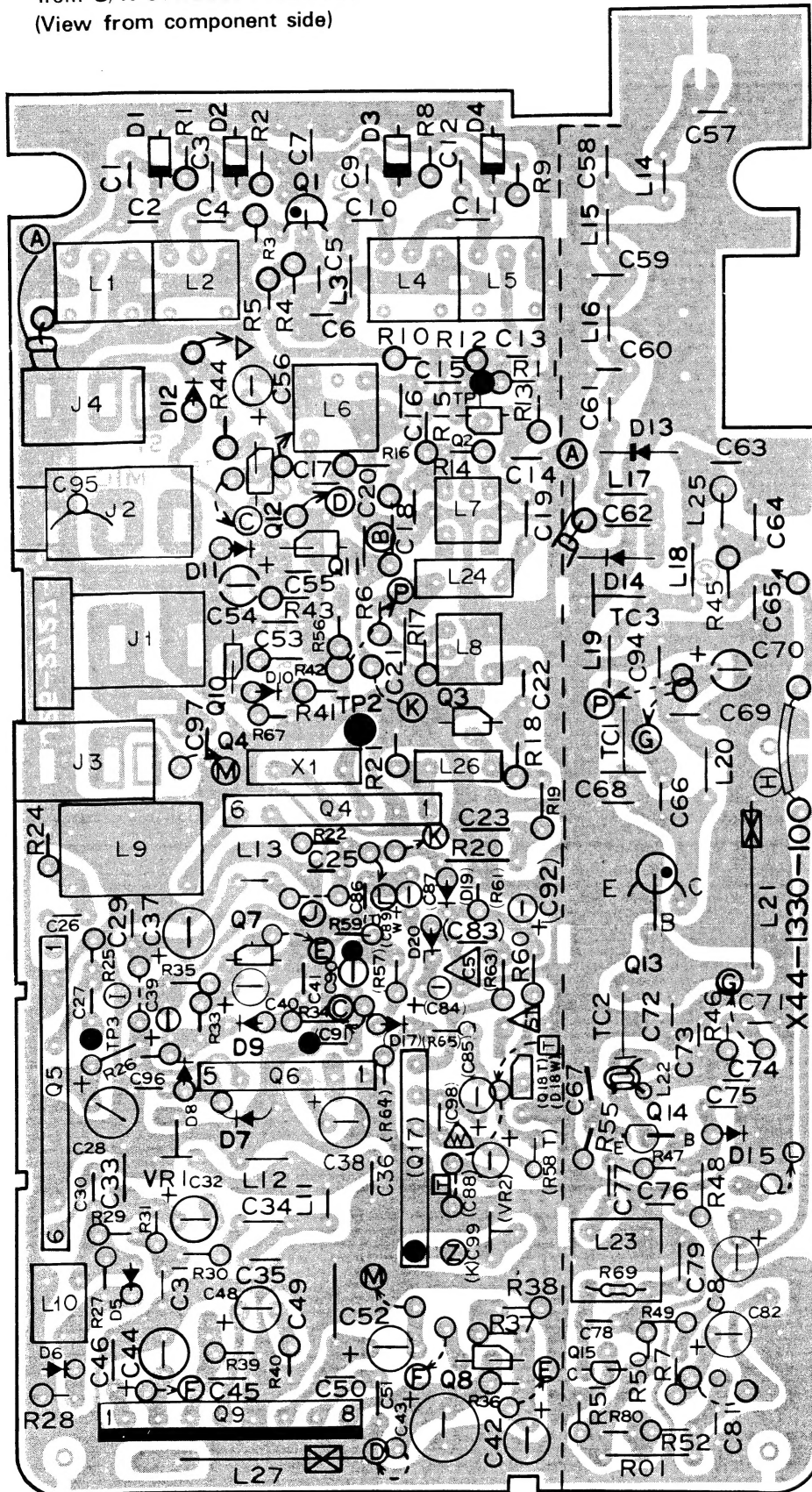
AFG05F1750A1



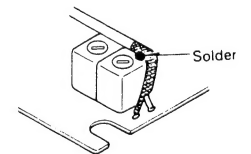
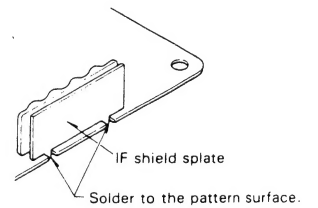
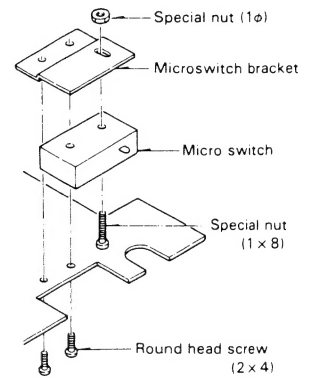
- | | |
|------------|----------------------|
| Q1 | : 2SC2212 |
| Q2 | : 2SC2668(Y) |
| Q3 | : 2SC2669(Y) |
| Q4 | : H8D1154E |
| Q5 | : H8D1152E |
| Q6 | : H8D1252 |
| Q7,8,10,11 | : 2SC2603(E) |
| Q9 | : M51182L |
| Q12 | : 2SA562TM(Y) |
| Q13 | : 2SC2329(K) |
| Q14 | : 2SC2053 |
| Q15 | : 2SC2026(K) |
| Q16 | : 2SA1115(E) |
| Q17 | : AFG05F1750A1 (W,T) |
| Q18 | : 2SC2603(E) (T) |
| D1~4 | : 1S2208 |
| D5~8 | : 1N60 |
| D9,12,15 | : 1S1555 |
| D10 | : XZ-080 |
| D11 | : WZ-071 |
| D13 | : MI301 |
| D14 | : 1S2588 |
| D16 | : 1N60 |
| D17 | : 1S1555 (W) (T) |
| D18 | : 1S1555 (W) |
| D19 | : 1S1555 (T) |
| D20 | : XZ-080 (W) (T) |

PRINTED CIRCUIT BOARD

▼ TX-RX unit (X44-1330-XX) XX: 10 (K), 51 (T), 61 (W)
 from S/N 011XXXX~108XXXX
 (View from component side)



Apply heat sink to the contact surfaces of heat sink, shielding plate and transistor.



Q1	: 2SC2212
Q2	: 2SC2668(Y)
Q3	: 2SC2669(Y)
Q4	: H8D1154E
Q5	: H8D1152E
Q6	: H8D1252
Q7,8,10,11	: 2SC2603(E)
Q9	: M51182L
Q12	: 2SA562TM(Y)
Q13	: 2SC2329(K)
Q14	: 2SC2053
Q15	: 2SC2026(K)
Q17	: AFG05F1750A1 (W,T)
Q18	: 2SC2603(E) (T)

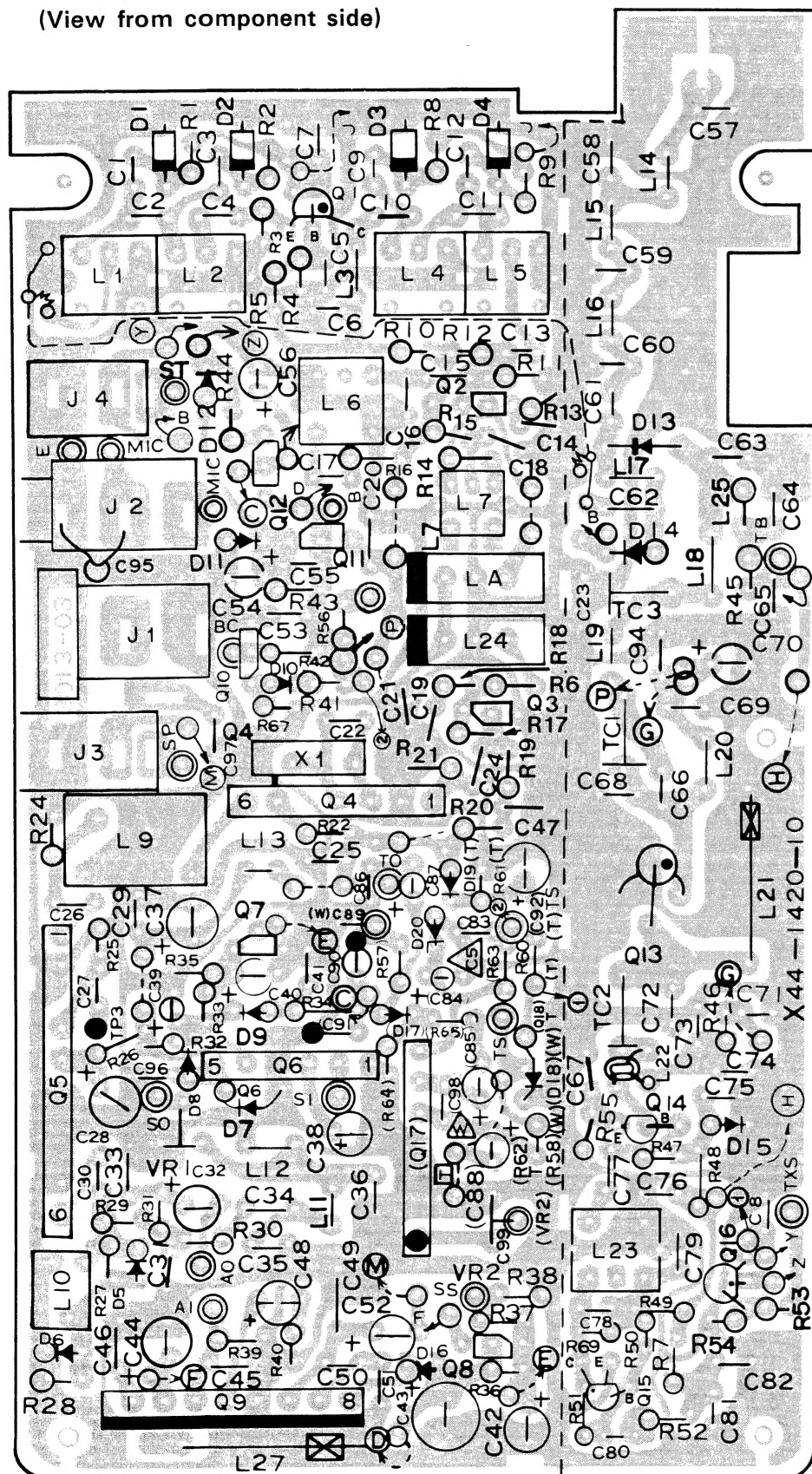
D1~4	: 1S2208
D5~8	: 1N60
D9,12,15	: 1S1555

D10	: XZ-080
D11	: WZ-071
D13	: MI301
D14	: 1S2588
D17	: 1S1555 (W) (T)
D18	: 1S1555 (W)
D19	: 1S1555 (T)
D20	: XZ-080 (W) (T)

TR-2400

PRINTED CIRCUIT BOARD

▼ TX-RX unit (X44-1420-XX) XX: 10(K), 51(T), 61(W)
from S/N 109XXXX ~
(View from component side)

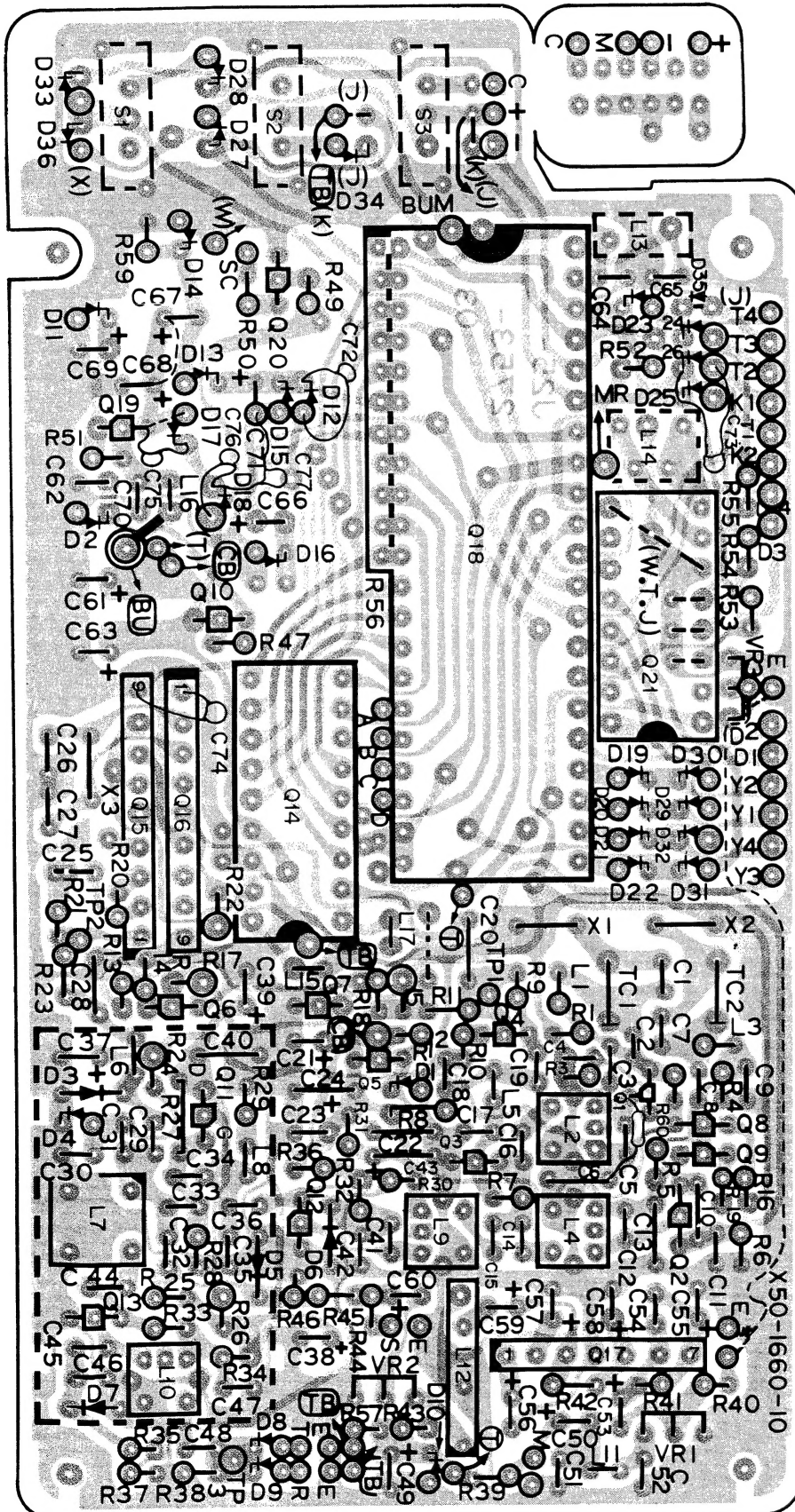


Q1	: 2SC2212
Q2	: 2SC2668 (Y)
Q3	: 2SC2669 (Y)
Q4	: H8D1154E
Q5	: H8D1152E
Q6	: H8D1252
Q7, 8, 10, 11, 16	: 2SC2603 (E)
Q9	: M51182L
Q12	: 2SA562TM (Y)
Q13	: 2SC2329 (K)
Q14	: 2SC2053
Q15	: 2SC2026 (K)
Q17	: AFG05F1750A1 (W) (T)
Q18	: 2SC2603 (E) (T)
D1~4	: 1S2208
D5~8	: 1N60
D9,12,15	: 1S1555
D10	: XZ-086
D11	: WZ-071
D13	: MI301
D14	: 1S2588
D17	: 1S1555 (W) (T)
D18	: 1S1555 (W)
D19	: 1S1555 (T)
D20	: XZ-080 (W) (T)

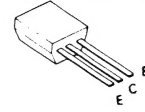
'R-2400

PRINTED CIRCUIT BOARD

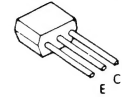
▼ PLL unit (X50-1660-XX) XX: 10(K), 51(T), 61(W) from S/N 011XXXX ~ 108XXXX
(View from component side)



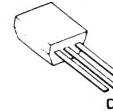
2SC2668
2SC2669



2SA1115E
2SC2603



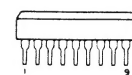
2SK192



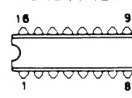
TA7061AP



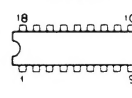
TC5081P
TC5082P



MK5087N
TC40174BP



TC9122P



μPD651C-013.017

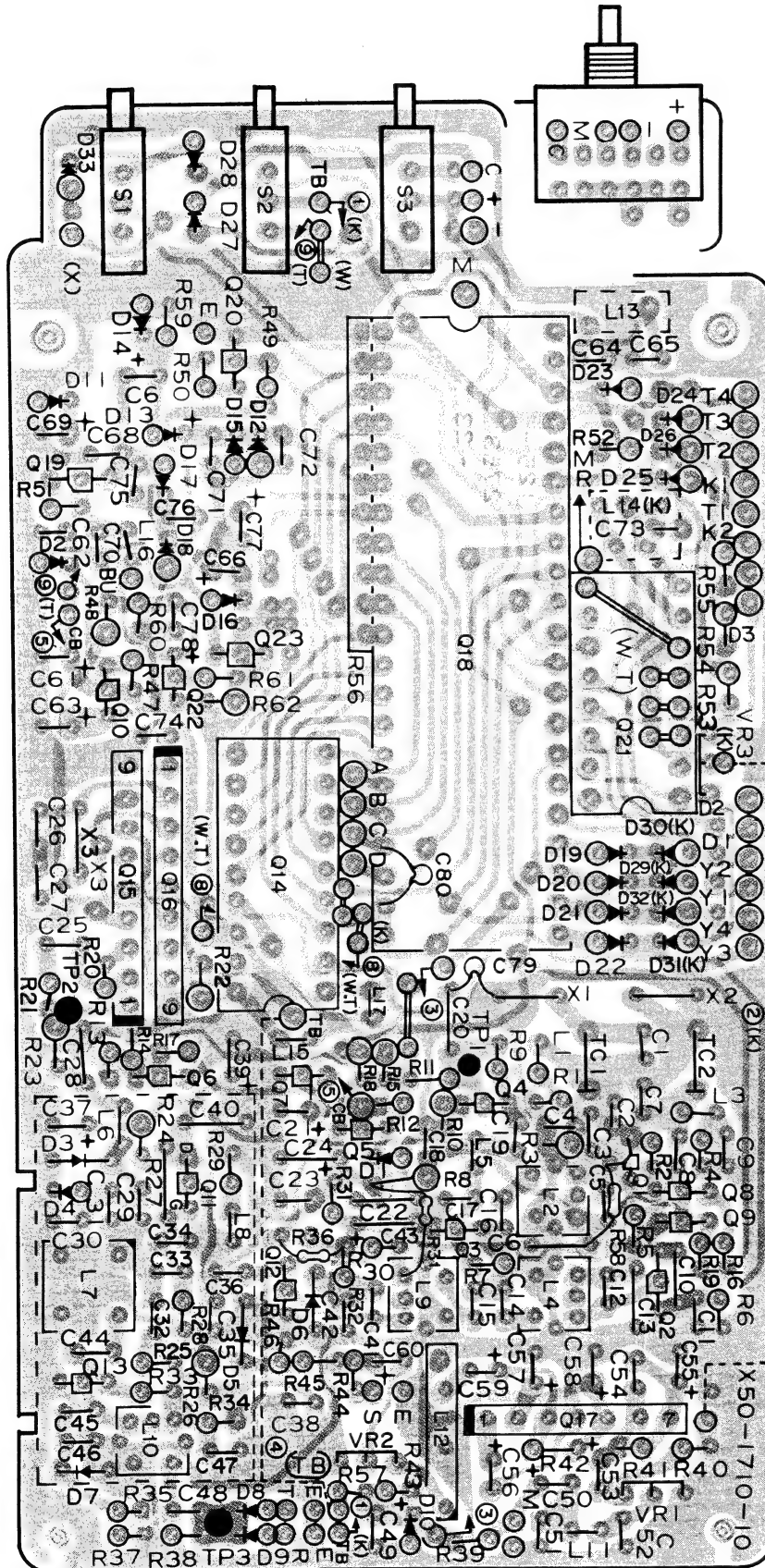


Q1,2 : 2SC2669(Y)
Q3,12,13 : 2SC2668(Y)
Q4 ~ 10,19,20 : 2SC2603(E)
Q11 : 2SK192(GR)
Q14 : TC9122P
Q15 : TC5081P
Q16 : TC5082P
Q17 : TA7061AP
Q18 : μPD651C-017
Q21 : MK5087N(K)

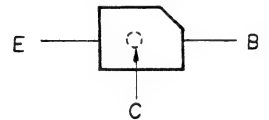
D1,2 : XZ-066
D3,6,7 : 1S2208
D4,8,9 : 1S2588
D5 : 1SV50S
D10 : XZ-088(K)
D10 : XZ-070(W,T)
D11 : XZ-060
D12 ~ 16 : 1S1555
D17 ~ 28,33 : 1N60
D29,30 ~ 32 : 1N60(K)

PRINTED CIRCUIT BOARD

▼ PLL unit (X50-1710-XX) XX: 10(K), 51(T), 61(W)
(View from component side) from S/N 109XXXX~



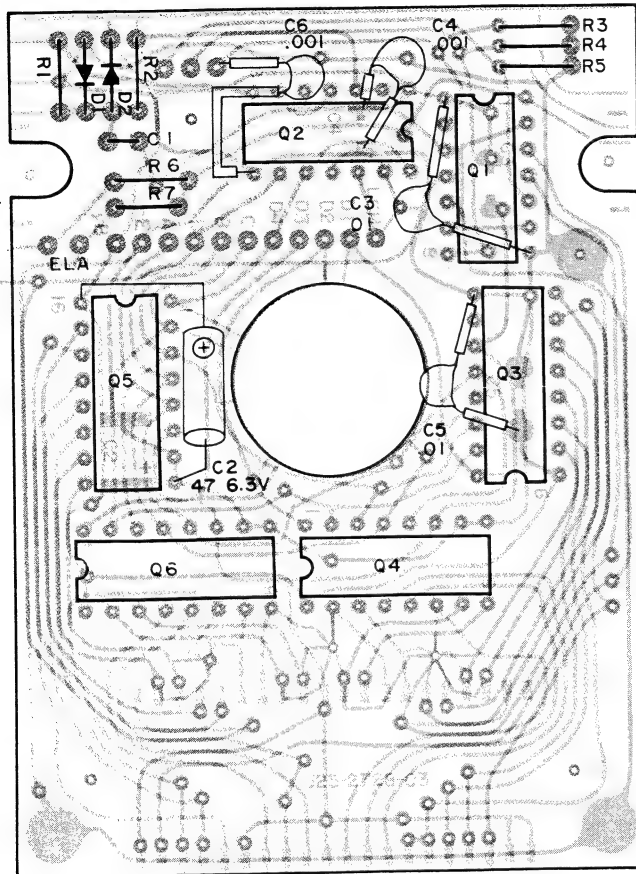
Transistor symbol



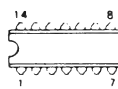
Q1,2	: 2SC2669 (Y)
Q3,12,13	: 2SC2668 (Y)
Q4~10,19,20,23	: 2SC2603 (E)
Q11	: 2SK192(GR)
Q14	: TC9122P
Q15	: TC5081P
Q16	: TC5082P
Q17	: TA7061AP
Q18	: μ PD651C-017
Q21	: MK5087N (K)
Q22	: 2SA1115 (E)
D1,2	: XZ-066
D3,6,7	: 1S2208
D4,8,9	: 1S2588
D5	: 1SV50S
D10	: XZ-088 (K)
D10	: XZ-070 (W)(T)
D11	: XZ-060
D12~16	: 1S1555
D17~28,33	: 1N60
D29~32	: 1N60 (K)

PRINTED CIRCUIT BOARD / LCD DATA

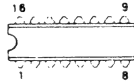
▼ DISPLAY unit (X54-1480-10) (View from foil side)



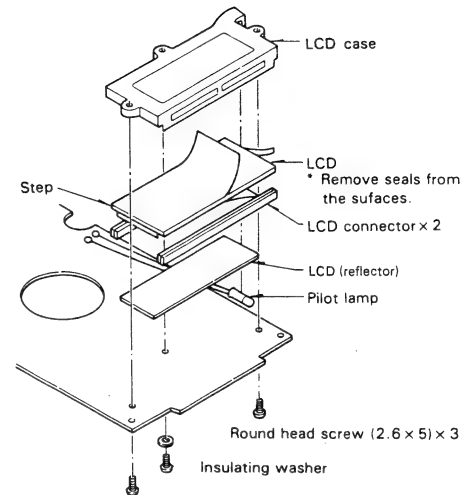
TC4011UBP
TC4030BP



TC4543BP



Q1 : TC4030BP
Q2 : TC4011UBP
Q3~6 : TC4543BP
D1,2 : 1S1555
V1 : F2025-30



LCD F2025-30 (Display unit V1)

Max rating (Absolute max. rating)

Item	Symbol	Min.	Max.	Unit
Storage temperature	T _{stg}	-20	60	°C
Operation temperature	T _{op}	-20	50	°C
Applied voltage	V _{OP}		10	V
Allowable DC voltage			25	mV

Recommendable operating condition

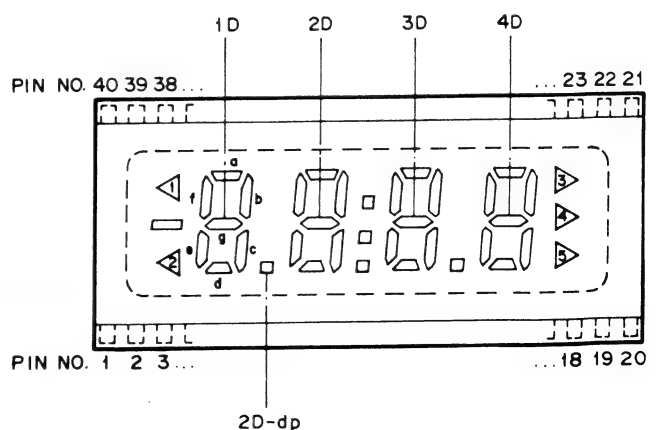
Item	Symbol	Min.	Norm.	Max.	Unit
Operating voltage	V _{op}	3	5	5.5	V
Operating frequency	f _{op}	30	32	35	Hz
Operating temperature	T _{OP}	-5	25	50	°C

Notes on operation

- Excessive force will damage the package.
If the liquid crystal leaks due to damage to the package, do not touch it. If the liquid crystal gets on your skin, wipe it off with alcohol and wash with water.
- Do not store or operate at high temperature or humidity.
- If it is exposed to direct sunlight, use the ultraviolet ray cut filter (cut-off frequency: approx. 460 nm).
- Do not apply a DC voltage as far as possible. (A DC voltage can be applied for only 1 minute.)

Pin connection

Pin No.	Segment	Pin No.	Segment
1	Common	21	Delta-3
2	Minus	22	4D-b
3	Delta-2	23	4D-a
4	1D-e	24	4D-f
5	1D-d	25	4D-g
6	1D-c	26	3D-b
7	2D-dp.	27	3D-a
8	2D-e	28	3D-f
9	2D-d	29	3D-g
10	2D-c	30	Colon
11	3D-dp.	31	2D-b
12	3D-e	32	2D-a
13	3D-d	33	2D-f
14	3D-c	34	2D-g
15	4D-dp.	35	1D-b
16	4D-e	36	1D-a
17	4D-d	37	1D-f
18	4D-c	38	1D-g
19	Delta-5	39	Delta-1
20	Delta-4	40	Common



PARTS LIST

Note 1:

K USA T Britain W Europe X Australia

Note 2:

Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the P.C. board illustration. Resistors not otherwise detailed are carbon type (1/4W or 1/8W). Order carbon resistors and capacitors according to the following example.

A carbon resistor's part number is RD14BY 2E222J.

A ceramic capacitor's number is CK45F1H103Z. CC45TH1H220J

RESISTOR

1. Type of the carbon resistor



2. Wattage

1W → 3A 3W → 3F 5W → 3H
2W → 3D 4W → 3G

3' = CC45 ○ ○ ...

Ceramic capacitor (type I) temperature coeff. capacitor 1' 3'

1st word (Color)	C (Black)	L (Red)	P (Orange)	R (Yellow)	S (Green)	T (Blue)	U (Violet)
ppm/°C	0	-80	-150	-220	-330	-470	-750

3 = CK45 ○

Ceramic capacitor (type II) 3

Cord	B	D	E	F
Operating temperature °C	-30 +85	-30 +85	-30 +85	-10 +70

6 = Tolerance

Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10 μF -10 ~ +50 Less than 4.7 μF -10 ~ +75

Less than 10 pF

Cord	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

Abbreviation		Abbreviation	
Cap.	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

3. Resistance value

② ② ② → means $22 \times 10^2 = 2200\Omega$ (2.2 kΩ)
Example 221 → 220Ω 223 → 22 kΩ 225 → 2.2 MΩ
222 → 2.2 kΩ 224 → 220 kΩ

4. Tolerance

J = ±5% (Gold) K = ±10% (Silver)

CAPACITORS

Type I

CC 45 TH 1H 220 J 1' 2 3' 4 5 6
1 = Type ... ceramic, electrolytic, etc.
2 = Shape ... round, square, etc.
3 = Temp range
3' = Temp coefficient

Type II

CK 45 F 1H 103 Z 1 2 3 4 5 6
4 = Voltage rat.ng
5 = Value
6 = Tolerance

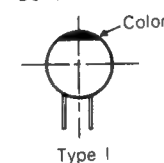
Ex. CC45TH = -470 ±60 ppm/°C

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

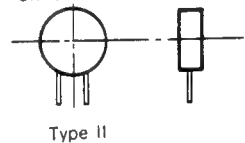
5 = Capacitor value

Example 010 → 1 pF
100 → 10 pF
101 → 100 pF
102 → 1000 pF = 0.001 μF
103 → 0.01 μF

CC45



CK45



TR-2400 SEMICONDUCTOR

☆: New parts

Item	Name	Parts No.	Re- marks
Diode	1N60	V11-0051-05	
	1S1555	V11-0076-05	
	1S2588	V11-0414-05	
	MI301	V11-0255-05	
Vari-Cap diode	1S2208	V11-0317-05	
	1SV50S	V11-1260-36	
Zener diode	WZ-071	V11-4160-86	
	XZ-055	V11-4173-16	
	XZ-060	V11-4101-20	
	XZ-066	V11-4173-06	
	XZ-070	V11-4161-96	
	XZ-080	V11-4163-46	
	XZ-086	V11-4163-36	
	XZ-088	V11-4163-56	
LCD	F2025-30	V11-3172-86	☆

Item	Name	Parts No.	Re- marks
TR	2SA562TM(Y)	V01-0562-16	
	2SA1115 (E)	V01-1115-16	☆
	2SC2026 (K)	V03-2026-16	
	2SC2053	V03-2053-06	
	2SC2212	V03-2212-06	☆
	2SC2329 (K)	V03-2329-16	
FET	2SC2603 (E)	V03-2603-06	
	2SC2668 (Y)	V03-2668-16	☆
	2SC2669 (Y)	V03-2669-16	☆
	2SK192 (GR)	V09-1016-06	☆
IC	AFG05F1750A1	V30-1141-06	☆
	H8D1152E	V30-1137-06	☆
	H8D1154E	V30-1138-06	☆
	H8D1252	V30-1139-06	☆

PARTS LIST

Item	Name	Parts No.	Re- marks
IC	M51182L	V30-1140-06	
	MK5087N	V30-1074-06	
	TA7061AP	V30-0039-05	
	TC4002BP	V30-0521-10	☆
	TC4011UBP	V30-1144-06	
	TC4030BP	V30-1143-06	☆

Item	Name	Parts No.	Re- marks
	TC401748P	V30-1145-06	
	TC4543BP	V30-1142-06	☆
	TC5081P	V30-1132-06	
	TC5082P	V30-1015-16	
	TC9122P	V30-1036-16	
	μPD651C-013	V30-1146-06	☆
	μPD651C-017	V30-1162-06	☆

○: from S/N 006XXXX~010XXXX

◎: from S/N 011XXXX~108XXXX

●: from S/N 109XXXX~

Ref. No.	Parts No.	Description	Re- marks
GENERAL ☆: New Parts			
—	A02-0607-02	Case (Front)	☆
—	A02-0608-02	Case (Rear)	☆
—	A21-0731-14	Ornamental panel (K type)	☆
—	A21-0734-14	Ornamental panel (W type)	☆
—	A21-0735-14	Ornamental panel (T type)	☆
—	A53-0301-03	Cover ass'y (Battery case)	☆
—	B03-0514-04	Switch mask × 3 (Push switch)	☆
—	B10-0626-04	Front glass	☆
—	B40-2494-24	Name plate (K type)	☆
—	B40-2496-14	Name plate (W type)	☆
—	B40-2497-04	Name plate (T type)	☆
—	B42-1677-04	Name plate (Key board) (K type)	☆
—	B42-1678-04	Name plate (Key board) (W, T type)	☆
—	B42-1679-14	Name plate (LCD)	☆
—	B43-0631-14	Badge (K, W type)	☆
—	B43-0634-14	Badge (T type)	☆
—	B46-0058-10	Warranty card (K type)	☆
—	B50-2689-10	Operating manual (K type)	☆
—	B50-2690-10	Operating manual (W type)	☆
—	B50-2691-10	Operating manual (T type)	☆
—	B58-0622-00	Warning plate	☆
—	E04-0251-05	BNC Receptacle	
—	E12-0001-05	Plug (Microphone)	
—	E12-0401-05	Plug (Stand-by)	
—	E31-2047-05	Cable with plug (Battery)	☆
—	F10-1267-04	Magnetic shield	☆
—	F15-0628-04	Shadow mask	☆
—	F15-0629-04	Jack mask (A)	☆
—	F15-0630-04	Jack mask (B)	☆
—	F20-0513-04	Insulating sheet (PLL U.—RX-TX U.)	☆
—	G01-0810-04	Coil spring (PTT)	☆
—	G02-0514-24	Earth spring	☆
—	G02-0527-04	Earth spring (B) LCD	☆
—	G13-0625-04	Sponge A (Speaker)	☆
—	G13-0626-04	Sponge B (Microphone)	☆
—	G13-0627-04	Sponge C (Cover)	☆
—	H01-2656-03	Carton case (K, W type)	☆
—	H01-2657-03	Carton case (T type)	☆
—	H10-2530-02	Packing fixture A	☆
—	H10-2531-04	Packing fixture B	☆
—	H10-2533-04	Cushion	☆
—	H20-1416-03	Protective cover	☆
—	H25-0049-03	Accessory bag	
—	J19-1331-03	Battery case	
—	J32-0740-04	Boss A (large) × 4	☆
—	J32-0741-04	Boss B (Small) × 2	☆

Ref. No.	Parts No.	Description	Re- marks
—	J32-0742-04	Boss C (Hand strap)	☆
—	J32-0743-04	Boss D	☆
—	J42-0424-04	Cap for DC jack	☆
—	J69-0301-03	Hand strap ass'y	☆
—	J69-0302-04	Both-side adhesive sheet	
—	K23-0730-04	Knob A (POWER, SQ.) × 2	☆
—	K23-0731-04	Knob B (TX-OFFSET)	☆
—	K27-0411-04	Push knob (SCAN, TONE, REV.) × 3	☆
—	K29-0730-04	Lever (PTT)	☆
—	N08-0504-04	Ornamental screw (Frame)	☆
—	N09-0616-04	Flat head screw (Key board) × 4	☆
—	N16-0026-46	Spring washer × 3	
—	N30-2004-41	Round head screw (Panel) × 3	
—	N30-2604-41	Round head screw (Case A, PTT) × 7	
—	N30-3008-45	Round head screw (Case B) × 2	
—	N30-3025-45	Round head screw (Case B) × 2	
—	N87-2005-46	Tap tight screw (Display unit) × 4	
—	R05-3409-15	Variable resistor 10kΩ (B) (VOL)	☆
—	R05-4403-05	Variable resistor 50KΩ (SQ.)	
—	S59-0402-05	Key board ass'y (K type)	☆ ○
—	S59-0403-05	Key board ass'y (W, T type)	☆ ○
—	S59-0404-05	Key board ass'y (K)	☆
—	S59-0405-05	Key board ass'y (W, T)	☆
—	T07-0206-05	Speaker	☆
—	T18-0051-05	Earphone	☆
—	T90-0311-05	Helical antenna	☆
—	T91-0312-05	Condenser microphone	☆
—	W09-0306-05	Nickel-Cadmium Battery pack	☆
—	W09-0307-15	Battery charger (K type)	☆
—	W09-0308-05	Battery charger (W type)	☆
—	W09-0309-05	Battery charger (T type)	☆
—	X44-1330-10	TX-RX UNIT (K type)	◎ ☆ ○
—	X44-1330-51	TX-RX UNIT (T type)	◎ ☆ ○
—	X44-1330-61	TX-RX UNIT (W type)	◎ ☆ ○
—	X44-1420-10	TX-RX UNIT (K type)	☆ ●
—	X44-1420-51	TX-RX UNIT (T type)	☆ ●
—	X44-1420-61	TX-RX UNIT (W type)	☆ ●
—	X50-1640-10	PLL UNIT (K type)	☆ ○
—	X50-1640-51	PLL UNIT (T type)	☆ ○
—	X50-1640-61	PLL UNIT (W type)	☆ ○
—	X50-1660-10	PLL UNIT (K)	☆ ○
—	X50-1660-51	PLL UNIT (T)	☆ ○
—	X50-1660-61	PLL UNIT (W)	☆ ○
—	X50-1710-10	PLL UNIT (K type)	☆ ●
—	X50-1710-51	PLL UNIT (T type)	☆ ●
—	X50-1710-61	PLL UNIT (W type)	☆ ●
—	X54-1480-10	DISPLAY UNIT	☆

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
TX·RX UNIT (X44-1330-XX) XX: 10(K), 51(T), 61(W)			
C1	CC45TH1H070D	C 7pF ± 0.5pF	
C2	CC45CH1H010C	C 1pF ± 0.25pF	
C3	CC45TH1H070D	C 7pF ± 0.5pF	
C4	CC45SL1H101J	C 100pF ± 5%	
C5,6	CK45B1H102K	C 1000pF ± 10%	
C7	C91-0462-05	Cap 0.0047μF	☆
C8		Not used	
C9	CC45TH1H070D	C 7pF ± 0.5pF	
C10	CC45CH1H220J	C 22pF ± 5%	
C11	CC45CH1H0R5C	C 0.5pF ± 0.25pF	
C12	CC45TH1H070D	C 7pF ± 0.5pF	
C13	CC45SL1H101J	C 100pF ± 5%	
C14	C91-0462-05	Cap. 0.0047μF	☆
C15	CC45CH1H0R5C	C 0.5pF ± 0.25pF	
C16	CC45TH1H070D	C 7pF ± 0.5pF	
C17	CC45CH1H070D	C 7pF ± 0.5pF	
C18	C91-0462-05	Cap. 0.0047μF	☆
C19	CC45CH1H070D	C 7pF ± 0.5pF	
C20	C91-0462-05	Cap 0.0047μF	☆
C21	CC45CH1H030C	C 3pF ± 0.25pF	
C22	CC45SL1H101J	C 100pF ± 5%	
C23	CQ92M1H103K	ML 0.01μF ± 10%	
C24		Not used	
C25	C91-0462-05	Cap. 0.0047pF	☆
C26	CK45B1H471K	C 470pF ± 10%	
C27	CK45B1H102K	C 1000pF ± 10%	
C28	CS15E1C220M	T 22μF 16V	
C29	C91-0462-05	Cap. 0.0047μF	☆
C30	CQ92M1H332K	ML 3300pF ± 10%	☆
C31	CQ92M1H222K	ML 2200pF ± 10%	
C32	CE04W1HR47M	E 0.47μF 50V	
C33	CQ92M1H333K	ML 0.033μF ± 10%	
C34	CQ92M1H153K	ML 0.015μF ± 10%	
C35	CQ92M1H102K	ML 1000pF ± 10%	
C36	CQ92M1H222K	ML 2200pF ± 10%	
C37	CE04W1A470M	E 47μF 10V	
C38	CS15E1A470M	T 47μF 10V	
C39	CS15E1C4R7M	T 4.7μF 16V	
C40	CS15E1E3R3M	T 3.3μF 25V	
C41	CK45B1H102K	C 1000pF ± 10%	
C42	CS15E1C4R7M	T 4.7μF 16V	
C43	CE04W1C101M	E 100μF 16V	
C44	CE04W1H010M	E 1μF 50V	
C45	CQ92M1H103K	ML 0.01μF ± 10%	
C46	C91-0457-05	Cap. 0.022μF	
C47		Not used	
C48	CS15E1C220M	T 22μF 16V	
C49	C91-0472-05	Cap 0.1μF ± 10%	
C50	CQ92M1H222K	ML 2200pF ± 10%	
C51	CQ92M1H392K	ML 3900pF ± 10%	
C52	CS15E1A470M	T 47μF 10V	
C53	CK45B1H102K	C 1000pF ± 10%	
C54	CE04W1C100M	E 10μF 16V	
C55	C91-0462-05	Cap. 0.0047μF	☆
C56	CE04W1C220M	E 22μF 16V	
C57	CC45SL1H220J	C 22pF ± 5%	
C58	CC45SL1H390J	C 39pF ± 5%	
C59	CC45SL1H220J	C 22pF ± 5%	
C60	CC45SL1H150J	C 15pF ± 5%	
C61	CK45B1H102K	C 1000pF ± 10%	
C62	CC45CH1H150J	C 15pF ± 5%	
C63	CC45SL1H220J	C 22pF ± 5%	
C64	C91-0462-05	Cap. 0.0047μF	☆
C65	CK45B1H102K	C 1000pF ± 10%	
C66	CC45CH1H220J	C 22pF ± 5%	
C67	CK45B1H102K	C 1000pF ± 10%	
C68	CC45CH1H050C	C 5pF ± 0.25pF	
C69	CK45B1H102K	C 1000pF ± 10%	
C70	C90-0825-05	E 22μF 16V	☆
C71	C91-0462-05	Cap. 0.0047μF	☆
C72	CC45CH1H220J	C 22pF ± 5%	
C73	C91-0462-05	Cap. 0.0047μF	☆
C74,75	CK45B1H102K	C 1000pF ± 10%	
C76	C91-0462-05	Cap 0.0047μF	☆
C77	CC45SL1H390J	C 39pF ± 5%	
C78	CC45TH1H050C	C 5pF ± 0.25pF	
C79	C91-0462-05	Cap. 0.0047μF	☆
C80	CC45CH1H270J	C 27pF ± 5%	
C81	CK45B1H102K	C 1000pF ± 10%	
C82	CS15E1A330M	T 33μF 10V	
C83	CK45B1H102K	C 1000pF ± 10%(W,T)	
C84	CE04W1C220M	E 22μF 16V(W,T)	
C85	CS15E1E010M	T 1μF 25V(W,T)	
C86	CK45B1H102K	C 1000pF ± 10%(W,T)	
C87	CS15E1E010M	T 1μF 25V(W,T)	
C88	CE04W1C220M	E 22μF 16V(W)	
C88	CE04W1HR47M	E 0.47μF 50V(T)	
C89	CK45B1H102K	C 1000pF ± 10%(W)	
C90	CS15E1C150M	T 15μF 16V(T)	
C91	CK45B1H102K	C 1000pF ± 10%(T)	
C92	CS15E1A150M	T 15μF 10V(T)	
C93		Not used	
C94	C91-0462-05	Cap. 0.0047μF	☆
C95~97	CK45B1H102K	C 1000pF ± 10%	
C98	CC45SL1H470J	C 47pF ± 5%(W,T)	
C99	CC45SL1H101J	C 100pF ± 5%(K)	
TC1	C05-0309-05	Ceramic trimmer 40pF	
TC2	C05-0067-05	Ceramic trimmer 25pF	
TC3	C05-0309-05	Ceramic trimmer 40pF	
J1	E03-0203-05	DC jack	☆
J2	E11-0408-05	MIC jack	☆
J3,4	E11-0407-05	Earphone jack	☆
—	F01-0745-04	Heat sink	☆
—	F10-1242-14	RX shield plate	☆
—	F10-1243-14	DRIVE shield plate	☆
—	F10-1244-14	IC shield plate	☆
—	F10-1245-04	TX shield plate	☆
—	F10-1251-04	IF shield plate	☆
L1,2	L31-0347-05	Tuning coil	
L3	L40-2292-01	Ferri-inductor 2.2μH	
L4~6	L31-0347-05	Tuning coil	
L7,8	L34-0891-05	Tuning coil	☆
L9	L72-0318-05	Ceramic filter CFG455F	☆
L10	L79-0446-05	Ceramic discriminator CFY455S	
L11	L40-1021-03	Ferri-inductor 1mH	
L12	L40-6825-04	Ferri-inductor 6.8mH	
L13	L40-1021-03	Ferri-inductor 1mH	
L14	L34-0894-05	Coil 3φ5T	☆
L15	L34-0893-05	Coil 3φ4T	☆
L16	L34-0894-05	Coil 3φ5T	☆
L17	L34-0892-05	Coil 2φ10T	☆
L18	L34-0893-05	Coil 3φ4T	☆
L19,20	L34-0895-05	Coil 3φ6T	☆
L21	L33-0632-05	Choke coil	☆
L22	L19-0321-05	Transformer (wide band)	☆
L23	L34-0897-05	Tuning coil	☆
L24	L71-0217-05	Monolithic filter 10T15A	☆
L25	L33-0002-05	Choke coil	
L26	L72-0014-05	Ceramic filter SFE10.7MA5	
L27	L33-0632-05	Choke coil	☆
X1	L77-0863-05	Quartz crystal 10.245MHz	☆
—	N09-0615-05	Special round head screw M1×8	☆
—	N14-0514-05	Special nut M1	☆

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
VR1	R12-3423-05	Semi-fixed resistor 22k Ω (B)	☆	C60	CC45SL1H150J	C 15pF $\pm 5\%$	
VR2	R12-3426-05	Semi-fixed resistor 30k Ω	☆	C61	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
	S50-1405-05	Micro-switch	☆	C62	CC45CH1H150J	C 15pF $\pm 5\%$	
TX.RX UNIT (X44-1420-XX) XX: 10 (K), 51(T), 61(W)				C63	CC45SL1H220J	C 22pF $\pm 5\%$	
C1	CC45TH1H070D	C 7pF ± 0.5 pF		C64	C91-0462-05	Cap. 0.0047 μ F	
C2	CC45CH1H010C	C 1pF ± 0.25 pF		C65	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C3	CC45TH1H070D	C 7pF ± 0.5 pF		C66	CC45CH1H220J	C 22pF $\pm 5\%$	
C4	CC45SL1H101J	C 100pF $\pm 5\%$		C67	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C5,6	CK45B1H102K	C 0.001 μ F $\pm 10\%$		C68	CC45CH1H050C	C 5pF ± 0.25 pF	
C7,8	C91-0462-05	Cap. 0.0047 μ F		C69	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C9	CC45TH1H070D	C 7pF ± 0.5 pF		C70	C90-0825-05	E 22 μ F 16V	
C10	CC45CH1H220J	C 22pF $\pm 5\%$		C71	C91-0462-05	Cap. 0.0047 μ F	
C11	CC45CH1H0R5C	C 0.5pF ± 0.25 pF		C72	CC45CH1H220J	C 22pF $\pm 5\%$	
C12	CC45TH1H070D	C 7pF ± 0.5 pF		C73	C91-0462-05	Cap. 0.0047 μ F	
C13	CC45SL1H101J	C 100pF $\pm 5\%$		C74,75	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C14	C91-0462-05	Cap. 0.0047 μ F		C76	C91-0462-05	Cap. 0.0047 μ F	
C15	CC45CH1H0R5C	C 0.5pF ± 0.25 pF		C77	CC45SL1H390J	C 39pF $\pm 5\%$	
C16	CC45TH1H070D	C 7pF ± 0.5 pF		C78	CC45TH1H050C	C 5pF ± 0.25 pF	
C17	CC45CH1H070D	C 7pF ± 0.5 pF		C79	C91-0462-05	Cap. 0.0047 μ F	
C18	C91-0462-05	Cap. 0.0047 μ F		C80	CC45CH1H270J	C 27pF $\pm 5\%$	
C19	CK45B1H681K	C 680pF $\pm 10\%$		C81	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C20	C91-0462-05	Cap. 0.0047 μ F		C82	CS15E1A330M	T 33 μ F 10V	
C21	CC45CH1H040C	C 4pF ± 0.25 pF		C83	CK45B1H102K	C 0.001 μ F $\pm 10\%$ (T) (W)	
C22	CC45CH1H220J	C 22pF $\pm 5\%$		C84	CE04W1C220Q	E 22 μ F 16V (T) (W)	
C23	CK45B1H102K	C 0.001 μ F $\pm 10\%$		C85	CS15E1E010M	T 1 μ F 25V (T) (W)	
C24	CK45B1H471K	C 470pF $\pm 10\%$		C86	CK45B1H102K	C 0.001 μ F $\pm 10\%$ (T) (W)	
C25	C91-0462-05	Cap. 0.0047 μ F		C87	CS15E1E010M	T 1 μ F 25V (T) (W)	
C26	CK45B1H471K	C 470pF $\pm 10\%$		C88	CE04W1HR47Q	E 0.47 μ F 50V (T)	
C27	CK45B1H102K	C 0.001 μ F $\pm 10\%$		C88	CE04W1C220Q	E 22 μ F 16V (W)	
C28	CS15E1C220M	T 22 μ F 16V		C89	CK45B1H102K	C 0.001 μ F $\pm 10\%$ (W)	
C29	C91-0462-05	Cap. 0.0047 μ F		C90	CS15E1C150M	T 15 μ F 16V (T)	
C30	CQ92M1H392K	M 0.0039 μ F $\pm 10\%$		C91	CK45B1H102K	C 0.001 μ F $\pm 10\%$ (T)	
C31	CQ92M1H222K	M 0.0022 μ F $\pm 10\%$		C92	CS15E1A150M	T 15 μ F 10V (T)	
C32	CE04W1HR47Q	E 0.47 μ F 50V		C94	C91-0462-05	Cap. 0.0047 μ F	
C33	C91-0473-05	Cap. 0.033 μ F $\pm 10\%$	☆	C95~97	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C34	CQ92M1H153K	M 0.015 μ F $\pm 10\%$		C98	CC45SL1H470J	C 47pF $\pm 5\%$ (T) (W)	
C35	CQ92M1H102K	M 0.001 μ F $\pm 10\%$		C99	CC45SL1H101J	C 100pF $\pm 5\%$ (K)	
C36	CQ92M1H222K	M 0.0022 μ F $\pm 10\%$		TC1	C05-0309-05	Ceramic trimmer 40pF	
C37	CE04W1A470Q	E 47 μ F 10V		TC2	C05-0067-05	Ceramic trimmer 25pF	
C38	CS15E1A470M	T 47 μ F 10V		TC3	C05-0309-05	Ceramic trimmer 40pF	
C39	CS15E1C4R7M	T 4.7 μ F 16V		J1	E03-0155-05	DC jack	☆
C40	CS15E1E3R3M	T 3.3 μ F 25V		J2	E11-0408-05	MIC jack	
C41	CK45B1H102K	C 0.001 μ F $\pm 10\%$		J3,4	E11-0407-05	Earphone jack	
C42	CS15E1C4R7M	T 4.7 μ F 16V		F01-0745-04		Heat sink	
C43	CE04W1C101Q	E 100 μ F 16V		F10-1242-14		RX shield plate	
C44	CE04W1H010Q	E 1 μ F 50V		F10-1243-14		Drive shield plate	
C45	C91-0473-05	Cap. 0.033 μ F $\pm 10\%$	☆	F10-1244-14		IC shield plate	
C46	C91-0457-05	Cap. 0.022 μ F		F10-1245-04		TX shield plate	
C47	C91-0462-05	Cap. 0.0047 μ F		F10-1251-04		IF shield plate	
C48	CS15E1C150M	T 15 μ F 16V		L1,2	L31-0347-05	Tuning coil	
C49	C91-0472-05	Cap. 0.1 μ F $\pm 10\%$		L3	L40-2292-01	Ferri-inductor 2.2 μ H	
C50	CQ92M1H222K	M 0.0022 μ F $\pm 10\%$		L4~6	L31-0347-05	Tuning coil	
C51	CQ92M1H392K	M 0.0039 μ F $\pm 10\%$		L7	L34-0891-05	Tuning coil	
C52	CS15E1A470M	T 47 μ F 10V		L9	L72-0316-05	Ceramic filter CFW455E	
C53	CK45B1H102K	C 0.001 μ F $\pm 10\%$		L10	L79-0446-05	Ceramic disci CFY455S	
C54	CE04W1C100Q	E 10 μ F 16V		L11	L40-1021-03	Ferri-inductor 1mH	
C55	C91-0462-05	Cap. 0.0047 μ F		L12	L40-6825-04	Ferri-inductor 6.8mH	
C56	C90-0825-05	E 22 μ F 16V		L13	L40-1021-03	Ferri-inductor 1mH	
C57	CC45SL1H220J	C 22pF $\pm 5\%$		L14	L34-0894-05	Coil 3 ϕ 5T	
C58	CC45SL1H390J	C 39pF $\pm 5\%$		L15	L34-0893-05	Coil 3 ϕ 4T	
C59	CC45SL1H220J	C 22pF $\pm 5\%$		L16	L34-0894-05	Coil 3 ϕ 5T	
				L17	L34-0892-05	Coil 2 ϕ 10T	

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
L18	L34-0893-05	Coil 3 ϕ 4T	
L19,20	L34-0895-05	Coil 3 ϕ 6T	
L21	L33-0632-05	Choke coil	
L22	L19-0321-05	Transformer (wide band)	
L23	L34-0897-05	Tuning coil	
L24	L71-0226-05	Monolithic filter 10T15B	☆
L25	L33-0002-05	Choke coil	
L27	L33-0632-05	Choke coil	
X1	L77-0863-05	Crystal 10.245MHz	
	N09-0615-05	Round screw M1 \times 8	
	N14-0514-05	Nut M1	
	N30-2004-41	Round screw	
	N30-2604-41	Round screw	
VR1	R12-3423-05	Trim. pot. 22k Ω (B)	
VR2	R12-3426-05	Trim. pot. 30k Ω (T) (W)	
	S50-1405-05	Micro-switch	
PLL UNIT (X50-1640-XX) XX: 10(K), 51(T), 61(W)			
C1	CC45CH1H100D	C 10pF \pm 0.5pF	
C2	CC45CH1H070D	C 7pF \pm 0.5pF	
C3	CC45CH1H220J	C 22pF \pm 5%	
C4	CC45CH1H180J	C 18pF \pm 5%	
C5,6	CC45CH1H030C	C 3pF \pm 0.25pF	
C7	CC45CH1H220J	C 22pF \pm 5%	
C8	CC45TH1H080D	C 8pF \pm 0.5pF	
C9	CS15E1VR47M	T 0.47 μ F 35V	
C10	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C11	CC45TH1H050C	C 5pF \pm 0.25pF	
C12	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C13	CC45CH1H220J	C 22pF \pm 5%	
C14,15	CC45CH1H050C	C 5pF \pm 0.25pF	
C16,17	CC45CH1H030C	C 3pF \pm 0.25pF	
C18	CC45SL1H101J	C 100pF \pm 5%	
C19	C90-0246-05	Cap. 0.01 μ F \pm 10%	
C20	CS15E1A150M	T 15 μ F 10V	
C21	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C22	CE04W1A330Q	E 33 μ F 10V	
C23	CQ92M1H472K	ML 4700pF 50V	
C24	CS15E1C1R5M	T 1.5 μ F 16V	
C25	CC45CH1H120J	C 12pF \pm 5%	
C26	CC45TH1H060D	C 6pF \pm 0.5pF	
C27	CC45CH1H020C	C 2pF \pm 0.25pF	
C28	CC45CH1H010C	C 1pF \pm 0.25pF	
C29	CC45CH1H080D	C 8pF \pm 0.5pF	
C30	CC45CH1H030C	C 3pF \pm 0.25pF	
C31	CC45CH1H050C	C 5pF \pm 0.25pF	
C32	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C33	CE04W1C100Q	E 10 μ F 16V	
C34	CC45CH1H030C	C 3pF \pm 0.25pF	
C35	CC45TH1H080D	C 8pF \pm 0.5pF	
C36	CC45TH1H010C	C 1pF \pm 0.25pF	
C37	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C38	CE04W1A470Q	E 47 μ F 10V	
C39,40	CS15E1V0R1M	T 0.1 μ F 35V	
C41	CE04W1A470Q	E 47 μ F 10V	
C42	CE04W1E4R7Q	E 4.7 μ F 25V	
C43	CE04W1C100Q	E 10 μ F 16V	
C44	CE04W1A330Q	E 33 μ F 10V	
C45	CK45B1H102K	C 1000pF \pm 10%	
C46	CE04W1A470Q	E 47 μ F 10V	
C47	CS15E1V0R1M	T 0.1 μ F 35V	
C48,49	CK45B1H102K	C 1000pF \pm 10%	
C50	CS15E1V0R1M	T 0.1 μ F 35V	
C51	CC45CH1H050C	C 5pF \pm 0.25pF	
C52	CK45B1H102K	C 1000pF \pm 10%	
C53	CC45TH1H080D	C 8pF \pm 0.5pF	
C54	CC45TH1H010C	C 1pF \pm 0.25pF	
C55	CC45CH1H330J	C 33pF \pm 5%	
C56	C90-0821-05	T (Non Polar) 4.7 μ F 3.15V	
C57	CC45CH1H180J	C 18pF \pm 5%	
C58	CC45CH1H330J	C 33pF \pm 5%	
C59	CE04W1C100Q	E 10 μ F 16V	
C60	CE04W1HR47Q	E 0.47 μ F 50V	
C61	C90-0822-05	E 47 μ F 16V	☆
C62	C91-0462-05	Cap. 0.0047 μ F	☆
C63	CS15E1VR33M	T 0.33 μ F 35V	
C64	CS15E0J470M	T 47 μ F 6.3V	
C65	CE04W1E4R7Q	E 4.7 μ F 25V	
C66	CS15E1VR68M	T 0.68 μ F 35V	
C67,68	CK45B1H102K	C 1000pF \pm 10%	
C69	CC45CH1H050C	C 5pF \pm 0.25pF	
C70	CC45SL1H121J	C 120pF \pm 5%	
C71	CC45CH1H330J	C 33pF \pm 5%	
C72	CE04W1C330Q	E 33 μ F 16V	
C73	CC45SL1H101J	C 100pF \pm 5%	
C74	CE04W1C330Q	E 33 μ F 16V	
C75	CC45CH1H120J	C 12pF \pm 5%	
TC1,2	C05-0303-05	Trimmer 20pF	
—	F10-1246-14	PLL shield plate	☆
—	F11-0765-04	VCO shield plate	☆
L1,2	L33-0605-05	Choke coil 47 μ H	
L3,4	L34-0890-05	Tuning coil	☆
L5	L40-1501-03	Ferri-inductor 15 μ H	
L6	L40-1092-01	Ferri-inductor 1 μ H	
L7	L32-0625-05	VCO coil	☆
L8	L40-1092-01	Ferri-inductor 1 μ H	
L9	L34-0890-05	Tuning coil	☆
L10	L40-1021-03	Ferri-inductor 1mH	
L11	L34-0890-05	Tuning coil	☆
L12	L78-0004-05	Ceramic oscillator 397KHz	☆
L13	L78-0003-05	Ceramic oscillator 3.58MHz (K)	☆
L14	L79-0458-05	Spurious filter AFL13F3500B1	☆
L15,16	L40-1001-01	Ferri-inductor 10 μ H	
X1	L77-0860-05	Quartz crystal 42.6MHz	☆
X2	L77-0861-05	Quartz crystal 46.1666MHz	☆
X3	L77-0862-05	Quartz crystal 10.240MHz	☆
R64	R90-0527-05	Resistor block 470K \times 10	☆
VR1	R12-3422-05	Trim. pot 20k Ω	☆
VR2	R12-2408-05	Trim. pot 5k Ω	☆
VR3	R12-3425-05	Trim. pot 10k Ω	
VR4	R12-2408-05	Trim. pot 5k Ω (K type)	☆
S1	S40-1401-05	Push switch SQUELCH	☆
S2	S40-1401-05	Push switch SUB TONE (K, T type)	☆
S2	S40-1402-05	Push switch (W type)	☆
S3	S40-1402-05	Push switch REVERSE	☆
—	S29-1416-05	Rotary switch TX OFFSET (K type)	☆
—	S29-1417-05	Rotary switch TX OFFSET (W, T type)	☆
PLL UNIT (X50-1660-XX) XX: 10(K), 51(T), 61(W)			
C1	CC45CH1H100D	C 10pF \pm 0.5pF	
C2	CC45CH1H220J	C 22pF \pm 5%	
C3	CC45CH1H030C	C 3pF \pm 0.25pF	
C4	CC45CH1H220J	C 22pF \pm 5%	
C5	CC45TH1H080D	C 8pF \pm 0.5pF	
C6	CK45F1H103Z	C 0.01 μ F +80%, -20%	
C7	CC45CH1H070C	C 7pF \pm 0.5pF	
C8	CC45CH1H180J	C 18pF \pm 5%	
C9	CC45CH1H030C	C 3pF \pm 0.25pF	

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
C10	CC45CH1H120J	C 12pF ±5%	
C11	CC45CH1H220J	C 22pF ±5%	
C12	CC45TH1H050C	C 5pF ±0.25pF	
C13	CK45FIH103Z	C 0.01μF +80%—20%	
C14~16	CC45CH1H050C	C 5pF ±0.25pF	
C17,18	CC45CH1H030C	C 3pF ±0.25pF	
C19	CC45SL1H101J	C 100pF ±5%	
C20	C90-0246-05	C 0.01μF ±10%	
C21	C90-0833-05	E 33μF 16V	
C22	CS15E1A150M	T 15μF 10V	
C23	C90-0832-05	E 47μF 10V	
C24	CK45FIH103Z	C 0.01μF +80.—20%	
C25	C90-0821-05	T 4.7μF 3.15V(Non polar)	
C26	CC45CH1H330J	C 33pF ±5%	
C27	CC45CH1H330J	C 33pF ±5%	
C28	CQ92MIH472K	ML 0.0047μF	
C29	CC45CH1H120J	C 12pF ±5%	
C30	CC45CH1H020C	C 2pF ±0.25pF	
C31	CC45TH1H060D	C 6pF ±0.5pF	
C32	CC45CH1H010C	C 1pF ±0.25pF	
C33	CC45CH1H080D	C 8pF ±0.5pF	
C34	CC45CH1H030C	C 3pF ±0.25pF	
C35	CC45CH1H050C	C 5pF ±0.25pF	
C36	CC45CH1H030C	C 3pF ±0.25pF	
C37	CS15E1E1R5M	T 1.5μF 25V	
C38	C90-0831-05	E 33μF 10V	
C39	C90-0830-05	E 10μF 16V	
C40	CK45FIH103Z	C 0.01μF +80.—20%	
C41	CC45TH1H080D	C 8pF ±0.5pF	
C42	CC45TH1H010C	C 1pF ±0.25pF	
C43	CK45FIH103Z	C 0.01μF +80.—20%	
C44	CC45CH1H050C	C 5pF ±0.25pF	
C45	CC45TH1H080D	C 8pF ±0.5pF	
C46	CC45TH1H010C	C 1pF ±0.25pF	
C47	CK45BIH102K	C 0.001μF ±10%	
C48	CC45CH1H330J	C 33pF ±5%	
C49	CE04W1A330Q	E 33μF 10V	
C50	CS15E1VORIM	T 0.1μF 35V	
C51,52	CK45BIH102K	C 0.001μF ±10%	
C53	CS15E1VORIM	T 0.1μF 35V	
C54	CK45BIH102K	C 0.001μF ±10%	
C55,56	CE04W1A470Q	E 47μF 10V	
C57	CE04W1E4R7Q	E 4.7μF 25V	
C58	CE04W1C100Q	E 10μF 16V	
C59,60	CS15E1VOR1M	T 0.1μF 35V	
C61	CE04W1C470Q	E 47μF 16V	
C62	C91-0462-05	Cap. 0.0047μF	
C63	CE04W1C100Q	E 10μF 16V	
C64	CC45CH1H330J	C 33pF ±5%	
C65	CC45SL1H121J	C 120pF ±5%	
C66	CS15E1VR33M	T 0.33μF 35V	
C67	CS15E1E100M	T 10μF 25V	
C68	CS15E1VR47M	T 0.47μF 35V	
C69	CS15E1C4R7M	T 4.7μF 16V	
C70	CK45BIH102K	C 0.001μF ±10%	
C71	CS15E1VR47M	T 0.47μF 35V	
C72	CK45B1H102K	C 0.001μF	
C73	CK45B1H102K	C 0.001μF (K)	
C74	CC45CH1H150J	C 15pF	
C75,76	CK45B1H102K	C 0.001μF	
C77	CS15E1C1R5M	T 1.5μF 16V	
TC1,2	C05-0303-05	Ceramic trimmer 20pF	

Ref. No.	Parts No.	Description	Re- marks
—	F10-1246-14	PLL Shield plate	
—	F11-0765-04	VCO Shield case	
L1	L33-0605-05	Choke coil 0.47μH	
L2	L34-0890-05	Tuning coil	
L3	L33-0605-05	Choke coil 0.47μH	
L4	L34-0890-05	Tuning coil	
L5	L40-1501-03	Ferri-inductor 15μH	
L6	L40-1092-01	Ferri-inductor 1μH	
L7	L32-0625-05	VCO coil	
L8	L40-1092-01	Ferri-inductor 1μH	
L9,10	L34-0890-05	Tuning coil	
L11	L40-1021-03	Ferri-inductor 1 mH	
L12	L79-0458-05	Spurious filter AFL13F 3500B1	
L13	L78-0004-05	Ceramic oscillator 397kHz	
L14	L78-0003-05	Ceramic oscillator 3.58 MHz (K)	
L15	L40-1001-01	Ferri-inductor 10μH	
L16	L40-4791-01	Ferri-inductor 4.7μH	
L17	L40-1001-01	Ferri-inductor 10μH	
X1	L77-0860-05	Crystal 42.6MHz	
X2	L77-0861-05	Crystal 46.1666MHz	
X3	L77-0862-05	Crystal 10.240MHz	
VR1	R12-2408-05	Trim. pot 5kΩ	
VR2	R12-3422-05	Trim. pot 20kΩ	
VR3	R12-2408-05	Trim. pot 5kΩ (K)	
R56	R90-0527-05	Resistor block 470kΩ × 10	
—	R92-0150-05	Short jumper	
—	S29-1416-05	Rotary switch TX OFF SET (K)	
—	S29-1417-05	Rotary switch TX OFF SET (W) (T)	
S1	S40-1401-05	Push switch BUSY	
S2	S40-1401-05	Push switch TONE (K) (T)	
S2	S40-1402-05	Push switch TONE (W)	
S3	S40-1401-05	Push switch REVERSE	
PLL UNIT (X50-1710-XX) XX: 10(K), 51(T), 61(W)			
C1,79	CC45CH1H100D	C 10pF ±0.5pF	
C2	CC45CH1H220J	C 22pF ±5%	
C3	CC45CH1H030C	C 3pF ±0.25pF	
C4	CC45CH1H220J	C 22pF ±5%	
C5	CC45TH1H080D	C 8pF ±0.5pF	
C6	CK45FIH103Z	C 0.01μF +80.—20%	
C7	CC45CH1H070D	C 7pF ±0.5pF	
C8	CC45CH1H180J	C 18pF ±5%	
C9	CC45CH1H030C	C 3pF ±0.25pF	
C10	CC45CH1H120J	C 12pF ±5%	
C11	CC45CH1H220J	C 22pF ±5%	
C12	CC45TH1H050C	C 5pF ±0.25pF	
C13	CK45FIH103Z	C 0.01μF +80.—20%	
C14~16	CC45CH1H050C	C 5pF ±0.25pF	
C17,18	CC45CH1H030C	C 3pF ±0.25pF	
C19	CC45SL1H101J	C 100pF ±5%	
C20	C90-0246-05	C 0.01μF ±10%	
C21	C90-0833-05	E 33μF 16V	
C22	CS15E1A150M	T 15μF 10V	
C23	C90-0832-05	E 47μF 10V	
C24	CK45FIH103Z	C 0.01μF +80.—20%	
C25	C90-0821-05	Cap. 4.7μF 3.15V Non polar	

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
C26.27	CC45CH1H330J	C 33pF $\pm 5\%$	
C28	CQ92M1H472K	ML 0.0047 μ F $\pm 10\%$	
C29	CC45CH1H120J	C 12pF $\pm 5\%$	
C30	CC45CH1H020C	C 2pF ± 0.25 pF	
C31	CC45TH1H060D	C 6pF ± 0.5 pF	
C32	CC45CH1H010C	C 1pF ± 0.25 pF	
C33	CC45CH1H080D	C 8pF ± 0.5 pF	
C34	CC45CH1H030C	C 3pF ± 0.25 pF	
C35	CC45CH1H050C	C 5pF ± 0.25 pF	
C36	CC45CH1H030C	C 3pF ± 0.25 pF	
C37	CS15E1E1R5M	T 1.5 μ F 25V	
C38	C90-0831-05	E 33 μ F 10V	
C39	C90-0830-05	E 10 μ F 16V	
C40	CK45F1H103Z	C 0.01 μ F $+80, -20\%$	
C41	CC45TH1H080D	C 8pF ± 0.5 pF	
C42	CC45TH1H010C	C 1pF ± 0.25 pF	
C43	CK45F1H103Z	C 0.01 μ F $+80, -20\%$	
C44	CC45CH1H050C	C 5pF ± 0.25 pF	
C45	CC45TH1H080D	C 8pF ± 0.5 pF	
C46	CC45TH1H010C	C 1pF ± 0.25 pF	
C47	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C48	CC45CH1H330J	C 33pF $\pm 5\%$	
C49	CE04W1A330M	E 33 μ F 10V	
C50	CS15E1V0R1M	T 0.1 μ F 35V	
C51.52	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C53	CS15E1V0R1M	T 0.1 μ F 35V	
C54	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C55.56	CE04W1A470M	E 47 μ F 10V	
C57	CE04W1E4R7M	E 4.7 μ F 25V	
C58	CE04W1C100M	E 10 μ F 16V	
C59.60	CS15E1V0R1M	T 0.1 μ F 35V	
C61	CE04W1C470M	E 47 μ F 16V	
C62	C91-0462-05	Cap. 0.0047 μ F	
C63	CE04W1C100M	E 10 μ F 16V	
C64	CC45CH1H330J	C 33pF $\pm 5\%$	
C65	CC45SL1H121J	C 120pF $\pm 5\%$	
C66	CS15E1VR33M	T 0.33 μ F 35V	
C67	CS15E1A100M	T 10 μ F 10V	
C68	CS15E1VR47M	T 0.47 μ F 35V	
C69	C90-0482-05	E 4.7 μ F 25V	
C70	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C71	CS15E1VR47M	T 0.47 μ F 35V	
C72	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C73	CK45B1H102K	C 0.001 μ F $\pm 10\%$ (K)	
C74	CC45CH1H150J	C 15pF $\pm 5\%$	
C75.76	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
C77	CS15E1C1R5M	T 1.5 μ F 16V	
C78	C90-0482-05	E 4.7 μ F 25V	
C80	CK45B1H102K	C 0.001 μ F $\pm 10\%$	
TC1.2	C05-0303-05	Ceramic trimmer 20pF	
	F10-1246-14	PLL shield plate	
	F11-0765-04	VCO shield case	
L1	L33-0605-05	Choke coil 0.47 μ H	
L2	L34-0890-05	Tuning coil	
L3	L33-0605-05	Choke coil 0.47 μ H	
L4	L34-0890-05	Tuning coil	
L5	L40-1501-03	Ferri-inductor 15 μ H	
L6	L40-1092-01	Ferri-inductor 1 μ H	
L7	L32-0625-05	VCO coil	
L8	L40-1092-01	Ferri-inductor 1 μ H	
L9.10	L34-0890-05	Tuning coil	
L11	L40-1021-03	Ferri-inductor 1mH	
L12	L79-0458-05	Spurious filter AFL13F3500B1	

Ref. No.	Parts No.	Description	Re- marks
L13	L78-0004-05	Ceramic oscillator 397kHz	
L14	L78-0003-05	Ceramic oscillator 3.58MHz (K)	
L15	L40-1001-01	Ferri-inductor 10 μ H	
L16	L40-4791-01	Ferri-inductor 4.7 μ H	
L17	L40-1001-01	Ferri-inductor 10 ϕ H	
X1	L77-0860-05	Crystal 42.6MHz	
X2	L77-0861-05	Crystal 46.1666MHz	
X3	L77-0862-05	Crystal 10.240MHz	
R56	R90-0527-05	Resistor block 470k Ω \times 10	
VR1	R12-2408-05	Trim. pot. 5k Ω	
VR2	R12-3422-05	Trim. pot. 20k Ω	
VR3	R12-2408-05	Trim. pot. 5k Ω (K)	
	S29-1416-05	Rotary switch TX OFFSET (K)	
	S29-1417-05	Rotary switch TX OFFSET (T) (W)	
S1	S40-1401-05	Push switch BUSY	
S2	S40-1401-05	Push switch TONE (K) (T)	
S2	S40-1402-05	Push switch TONE (W)	
S3	S40-1401-05	Push switch REVERSE	
DISPLAY UNIT (X54-1480-10)			
—	B11-0408-05	LCD reflector	☆
—	B30-0815-05	Pilot lamp 12.6V 30mA	☆
C1	C91-0426-05	Laminated capacitor 0.022 μ F	
C2	C90-0832-05	Electrolytic 47 μ F 10V	☆
C3	C91-0464-05	C 0.01 μ F	
C4	CK45B1H102K	C 1000pF $\pm 10\%$	
C5	C91-0464-05	C 0.01 μ F	
C6	CK45B1H102K	C 1000pF $\pm 10\%$	
—	E29-0415-15	LCD connector	☆
—	F07-0831-04	LCD case	☆
—	N09-0627-05	Round screw $\times 3$ 2.6 \times 5	☆
—	N19-0619-04	Insulating washer	☆

PACKING

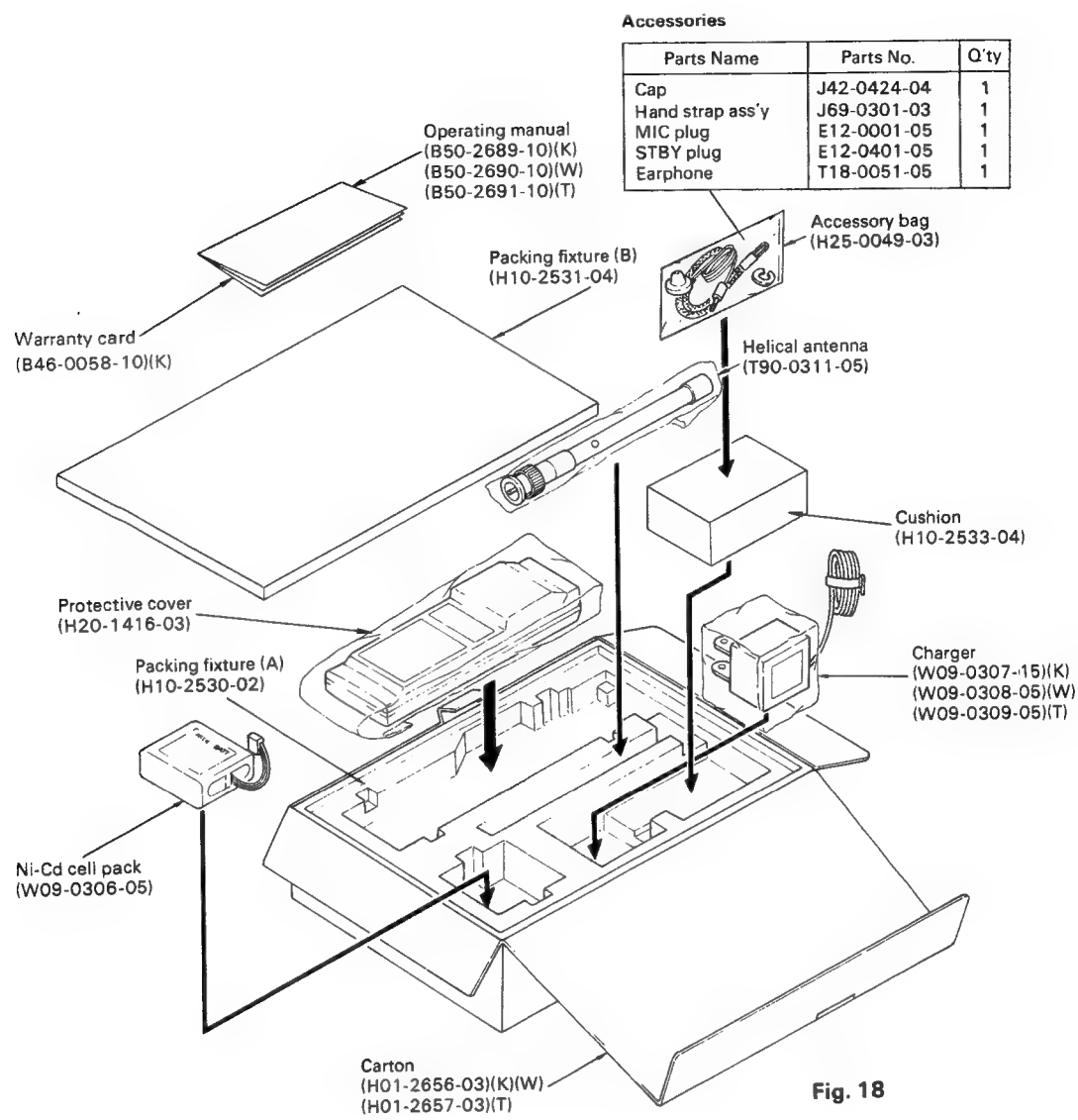


Fig. 18

DISASSEMBLY

STEPS

1. Remove rear case screws.
2. Remove battery compartment screws.
3. Separate front and rear case halves.

No.	Parts No.	Description
1		Frame
2	K29-0730-04	P.T.T lever
3	G01-0810-04	Coil spring
4	E04-0251-05	BNC Receptacle
5	E23-0513-05	Grounding lug
6	R05-3409-15	Variable resistor (AF VOL)
7	R05-4403-05	Variable resistor (SQ)
8	J19-1331-03	Battery case
9	E31-2047-05	Cable with plug (Battery)
10	S29-1416-05	Rotary switch (K type)
11	S29-1417-05	Rotary switch (W, T type)
12	A21-0731-14	Ornamental panel (K type)
13	A21-0734-14	Ornamental panel (W type)
14	A21-0735-14	Ornamental panel (T type)
15	X44-1330-XX	TX, RX unit
16	or X44-1420-XX	
17	A02-0607-02	Case (Front)
18	S59-0402-05	Key board ass'y (K type)
19	or S59-0404-05	
20	S59-0403-05	Key board ass'y (W, T type)
21	or S59-0405-05	
22	T07-0206-05	Speaker
23	G13-0625-04	Sponge A
24	T91-0312-05	Condenser microphone
25	G13-0626-04	Sponge B
26	B10-0626-04	Front glass
27	X54-1480-10	Display unit
28	B42-1679-14	Name plate (LCD)
29	F15-0628-04	Shadow mask
30	F20-0513-04	Insulating sheet
31	X50-1640-XX	PLL unit
32	X50-1660-XX	or
33	X50-1710-XX	
34	B03-0514-04	Switch mask
35	K27-0411-04	Push knob
36	K23-0730-04	Knob A
37	K23-0731-04	Knob B
38	A53-0301-03	Cover ass'y
39	A02-0608-02	Case (Rear)
40	B40-2494-14	Name plate (K type)
41	B40-2496-04	Name plate (W type)
42	B40-2497-04	Name plate (T type)
43	J69-0302-04	Both-side adhesive sheet
44	G13-0627-04	Sponge C
45	N08-0504-04	Ornamental screw
46	J32-0742-04	Boss C
47	J32-0743-04	Boss D
48	B43-0631-14	Badge (K, W type)
49	B43-0634-04	Badge (T type)
50		Mylar tape
51	G02-0514-24	Earth spring
52	J32-0740-04	Boss A
	J32-0741-04	Boss B
	N30-3025-45	Screw 3 x 25
	N30-3008-45	Screw 3 x 8
		Both-side adhesive sheet
	G02-0527-04	Earth spring (B)
	F15-0629-04	Jack mask (A)
	F15-0630-04	Jack mask (B)
	J42-0424-04	Cap for DC jack
		tape
	F10-1267-04	magnetic shield
		Double faced tape
		Tape

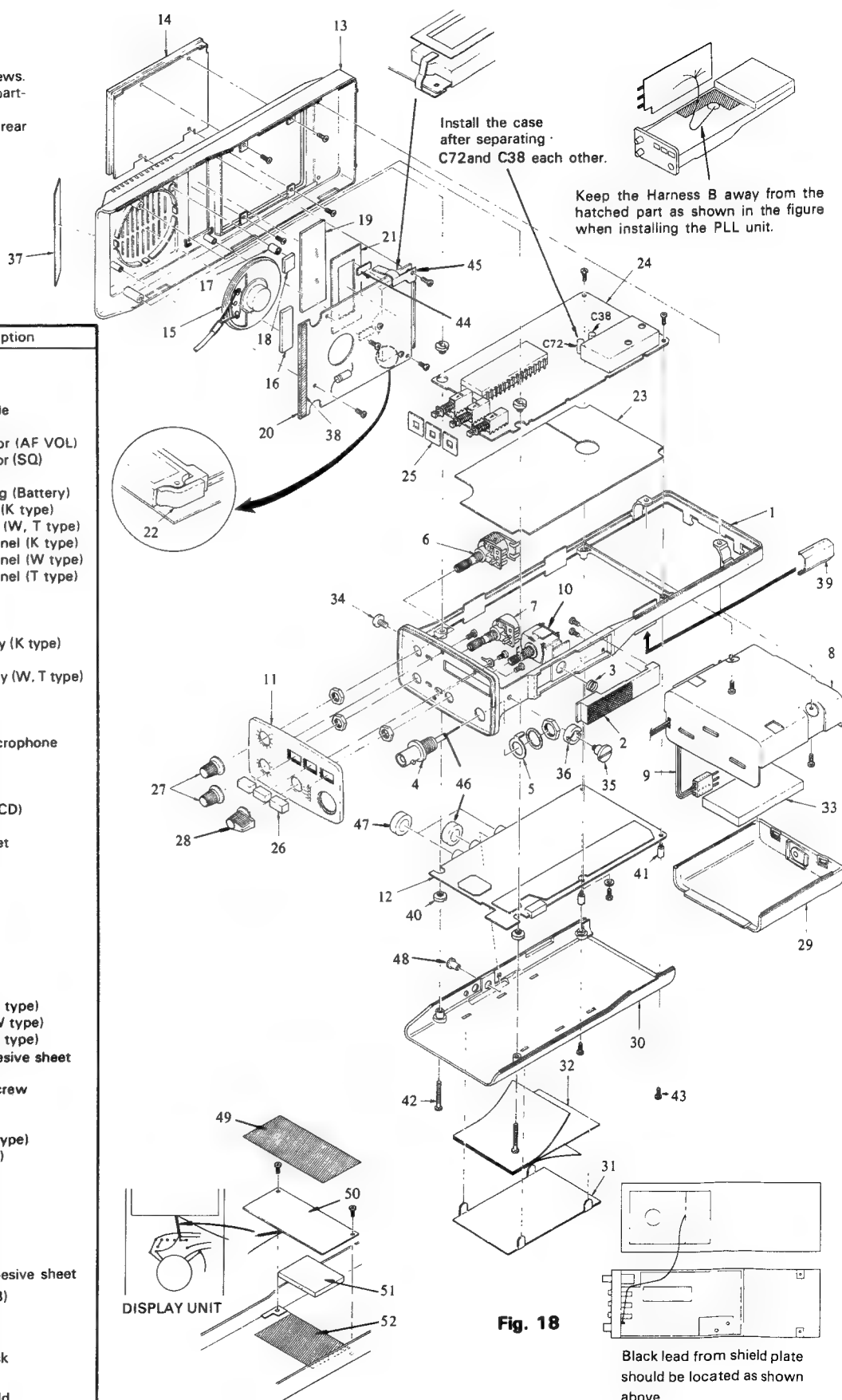


Fig. 18

Black lead from shield plate should be located as shown above.

μPD651C-017 Terminal function (PLL unit X50-1660-XX, Q18)

Pin No.	Terminal Name	Input Signal	Output Signal	Description	Pulse
1	CL1			Clock signal 397 kHz	
2	PC0		○	X100 program data output	at 145.000 MHz H
3	PC1		○		H
4	PC2		○		L
5	PC3		○		L
6	INT	○		H at transmit and receive, L at BACK UP ON	
7	RES	○		H for a moment at power ON with BACK UP OFF, Normally L	
8	PD0		○	X10 program data output	at 145.000 MHz L
9	PD1		○		L
10	PD2		○		L
11	PD3		○		L
12	PE0		○	X1 program data output	at 145.000 MHz L
13	PE1		○		L
14	PE2		○		L
15	PE3		○		L
16	PF0		○	BCD display output	○
17	PF1		○	Pulse output at receive	○
18	PF2		○	Only one cycle pulse output at transmit	○
19	PF3		○		○
20	TEST	○		DC 5V	
21	Vcc	○		DC 5V	
22	PG0		○	Key board line output	2nd line 4-5-6-MS
23	PG1		○		1st line 1-2-3-C
24	PG2		○		4th line ▼-0-▲-M
25	PG3		○		3rd line 7-8-9-MR
26	PH0		○	Digital display output	
27	PH1		○		
28	PH2		○		
29	PH3		○		
30	PI0		○	Key lock, Reverse, Squelch OPEN/BUSY output	○
31	PI1		○	Repeater common output	○
32	PI2		○	MR indication at H	
33	PA0	○		H } K type L } T, W type	
34	PA1	○			
35	PA2	○		H at receive, L at transmit	
36	PA3	○		H at squelch ON, L at scan stop	
37	PB0	○		Key board column input 1-4-7-▼	Repeater ⊕ input, reverse input
38	PB1	○		2-5-8-0	Repeater ⊖ input, key lock input
39	PB2	○		3-6-9-▲	
40	PB3	○		C-MS-MR-M	Repeater M input
41	Vss			GND	
42	CLO			Clock signal 397 kHz	

Key board ass'y (S59-0402-05)
(S59-0403-05)

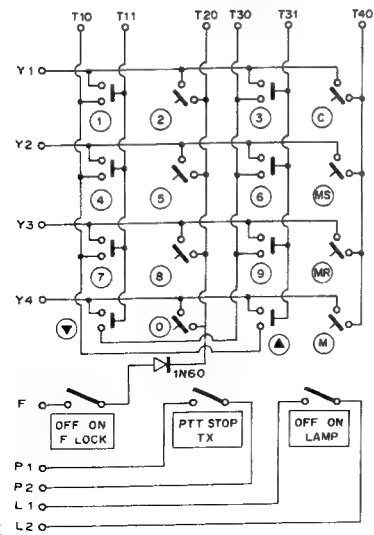


Fig. 16

Key board ass'y
(S59-0404-05)
(S59-0405-05)

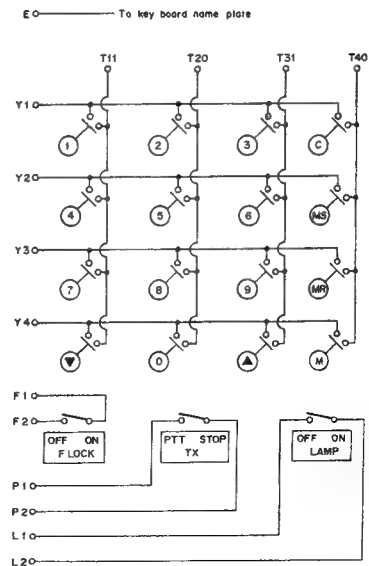
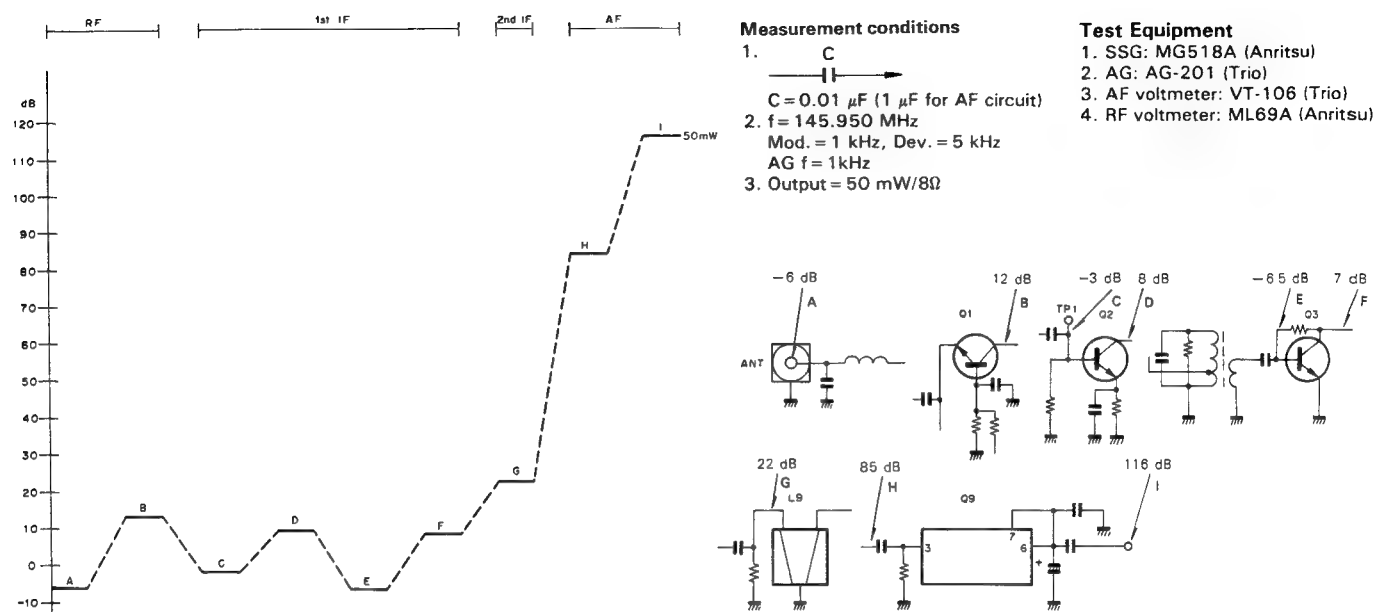


Fig. 17

LEVEL DIAGRAM

RX Section



TX section

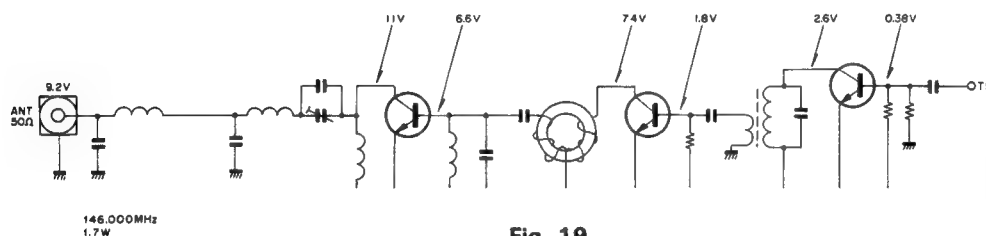


Fig. 19

Measurement conditions

1. $f = 146.000 \text{ MHz}$
2. Output = 1.7 W

ADJUSTMENT

TEST EQUIPMENT REQUIRED

1. RF VTVM

- Input impedance: 1M Ω min., 20pF max.
- Voltage range: 10 mV to 300 V
- Frequency range: 200 MHz min.

2. Power Meter

- Impedance: 50 Ω
- Measuring range: 5W
- Frequency range: 150 MHz min.

3. DC Power Supply

- Voltage: Variable from 6V to 12V
- Current: 1 A min.

4. Linear Detector

5. Directional Coupler

6. Oscilloscope

With horizontal input terminal and high sensitivity.

7. Audio Voltmeter

- Frequency range: 50Hz to 10kHz
- Input impedance: More than 1 M Ω
- Voltage range: 3 mV to 30V

8. AF Oscillator

- Frequency range: 300 Hz to 5 kHz
- Output: 0.5 mV to 1 V

9. Frequency Counter

- Minimum input sensitivity: About 50mV
- Frequency range: 150 MHz min.

10. SSG (Standard Signal Generator)

- Capable of covering 144~148 MHz
- Capable of Frequency modulation.

11. DVM (Digital Voltmeter).

12. Audio Dummy Load.

- 8 Ω , 5W (approx.)

ADJUSTMENT

BEFORE ADJUSTMENT

If you are making adjustments or repairs for the first time, or if you are not familiar with the proper way of handling the transceiver, read these instructions first before attempting adjustment or repair. It is necessary to keep the following in mind.

Alignment tools

- (1) When adjusting the trimmers or coils, use a non-inductive alignment tool made of delrin plastic, nylon, or ceramic material.
- (2) This transceiver uses miniature semi-fixed variable resistors. Use a flat blade screwdriver which correctly matches the part to be adjusted.

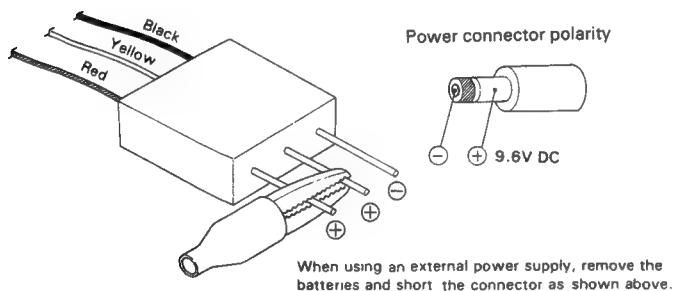


Fig. 20

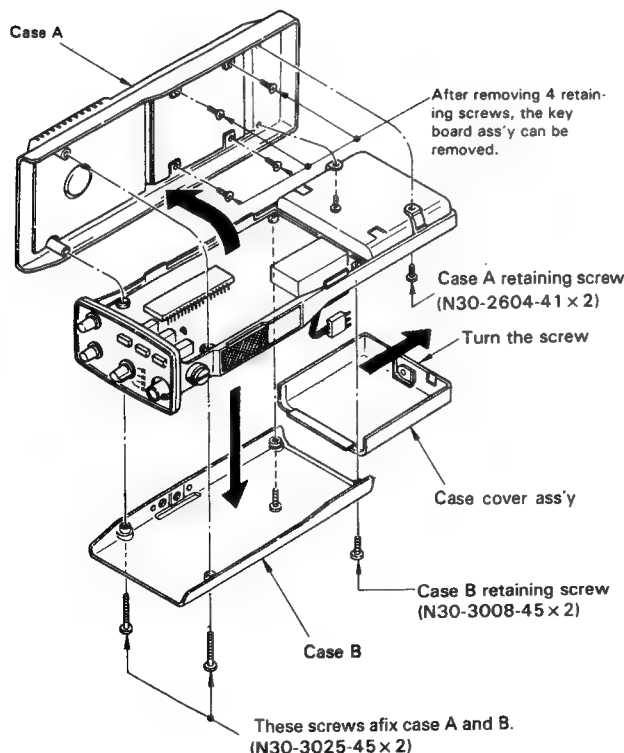


Fig. 21

Operation on External Power

When operating the transceiver on external power, connect the power cord to the CHARGE jack, making sure that the polarity is correct. Refer to Fig. 20.

RECEIVER UNIT INSPECTION AND ADJUSTMENT

Before inspection or adjustment, set the TX switch to the STOP position. Use an RF FUSE between the SSG output and transceiver input. The fuse will protect the generator against accidental transmitter damage.

★ The SSG output level as indicated is open circuit voltage.

1. Control and Switch Settings

Power Switch	ON
TX OFFSET Switch	BU OFF
Squelch Control	Minimum
BUSY/OPEN Switch	BUSY
S. TONE switch	OFF
REV/NORM Switch	NORM

2. Checking the Micro Processor

1) Power voltage

Check the following using a DVM.

- a. Voltage of 4.7~5.2V should be present at Q25 pin 21 (X50-1640-XX) or Q18 (X50-1660-XX, X50-1710-XX) on the PLL unit.
- b. Voltage of 5~5.5 V should be present at C2 (+) on the indicator unit.
- c. With the PTT switch depressed, 9.6V should be present at the TB line on the PLL unit.

2) Turn the power switch ON and check that the indicator displays 5.000.

3) Key Board frequency entry.

- a. The 1st digit (MHz) of the indicator should be 4, 5, 6 or 7 (K type), or 4 or 5 (W, T type). No other figures should indicate.
- b. The 2nd digit (100 kHz) and 3rd digit (10 kHz) should indicate as entered by the numeral keys.
- c. The 4th digit (1 kHz) should be 0 when the 0, 1, 2, 3 or 4 key is depressed, and should be 5 when the 5, 6, 7, 8 or 9 Key is depressed.
- d. The indicator should display 5.000 when the "C" key is depressed.
- e. The frequency display should advance 5 kHz each time the "▲" key is depressed. The display should continuously advance when this key is kept depressed.

* Over-range: The display should repeat between 3.900 and 8.495 (K type only).

- f. The indicator should count down the frequency as above when the "▼" key is depressed.
- g. With a given frequency displayed, press the M1~0 keys in order to check the memory function. The "◀" MR flag should appear at the conclusion of a memory input.

ADJUSTMENT

- h. The frequencies stored in memory should be displayed when the "MR" and 1~0 keys are pressed.
- * The frequency is displayed following the channel number. By pressing the "MR" key, the frequency display goes off and a channel number appears for about a second.
- i. The memories should be scanned when the "MS" key is pressed.
- * When the "MS" key is pressed, MS can only be released by the "STOP" key. In the MS mode, key input is not possible.
- j. No key inputs are possible when the F. LOCK switch is ON.

3. PLL Unit Adjustment

1) PLL IF Adjustment

- Set the frequency to 6.000 (5.000 for W, T type) and connect an RF VTVM to TP1
- Adjust L3 (X50-1640-XX) or L2 (X50-1660-XX, X50-1710-XX) and L9 for maximum meter reading.
- Transmit and adjust L4 for maximum reading.

2) Setting of PLL Voltage

- Set the frequency to 4.000 and connect a digital voltmeter to TP2.
- Adjust L7 for 1.5V.
- Next, set the frequency to 7.995 and check that voltage is less than 4.5 V.
- Transmit and check that the voltage between the frequencies 4.000 to 7.995 is between 1~4.5 V.

3) Frequency adjustment

- Set the frequency to 6.000 and connect a frequency counter to TP3.
- Adjust TC1 for 135.300 MHz.
- Transmit and adjust TC2 for 146.000 MHz.

4. Adjustment of Backup Circuit (X50-1640-XX)

- Set the TX OFFSET switch to the "S" position and connect a digital voltmeter to the Q25 pin 21.
- With the power switch set to OFF, adjust VR3 for 4.7 V.

5. Transmitter Unit Adjustment

- Set the frequency to 146.000 MHz and connect a power meter to the antenna.
- With the transceiver in transmit mode, adjust L11 (X50-1640-XX) or L10 (X50-1660-XX; X50-1710-XX) in the PLL unit and L23 and TC2 in the TX-RX unit for maximum DC current consumption.
- Adjust TC1 and TC3 observing both the power meter and current consumption. Obtain maximum power output for minimum current. The power should be more than 1.5W within the band.

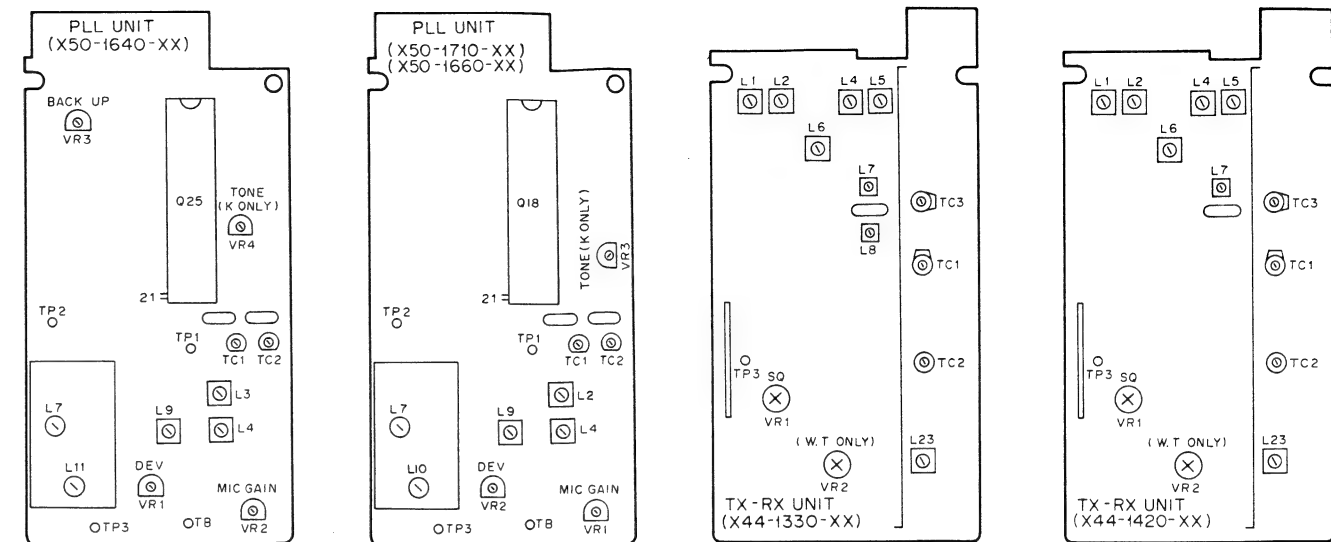
6. Modulator Adjustment

- Connect a linear detector to the unit.
- Set the frequency to 146.000 MHz and apply 35 mV at 1 kHz from the AG output through a 10 μ F/16V capacitor to the MIC terminal. Transmit and adjust VR1 (X50-1640-XX) or VR2 (X50-1660-XX, X50-1710-XX) in the PLL unit for 4.5 kHz.
- * Connect a capacitor of 10 μ F/16V between the MIC terminal and the AG output.
- Decrease the AG output to 3.5 mV and adjust VR1 (X50-1640-XX) or VR2 (X50-1660-XX, X50-1710-XX) in the PLL unit for 3.5kHz deviation.
- Increase the AG output back to 35mV and check that deviation still indicates 4.5 kHz.
- * Set the frequency to 144.000 MHz and 147.995 MHz and check that the maximum deviation is within 5 kHz.
- Disconnect the AG and press the "C" key in transmit mode. Adjust VR4 (X50-1640-XX) or VR3 (X50-1660-XX, X50-1710-XX) in the PLL for 3 kHz deviation (K type only).
- Vary the power supply voltage between 8.1~11.5V, and check with the linear detector for abnormal oscillations.

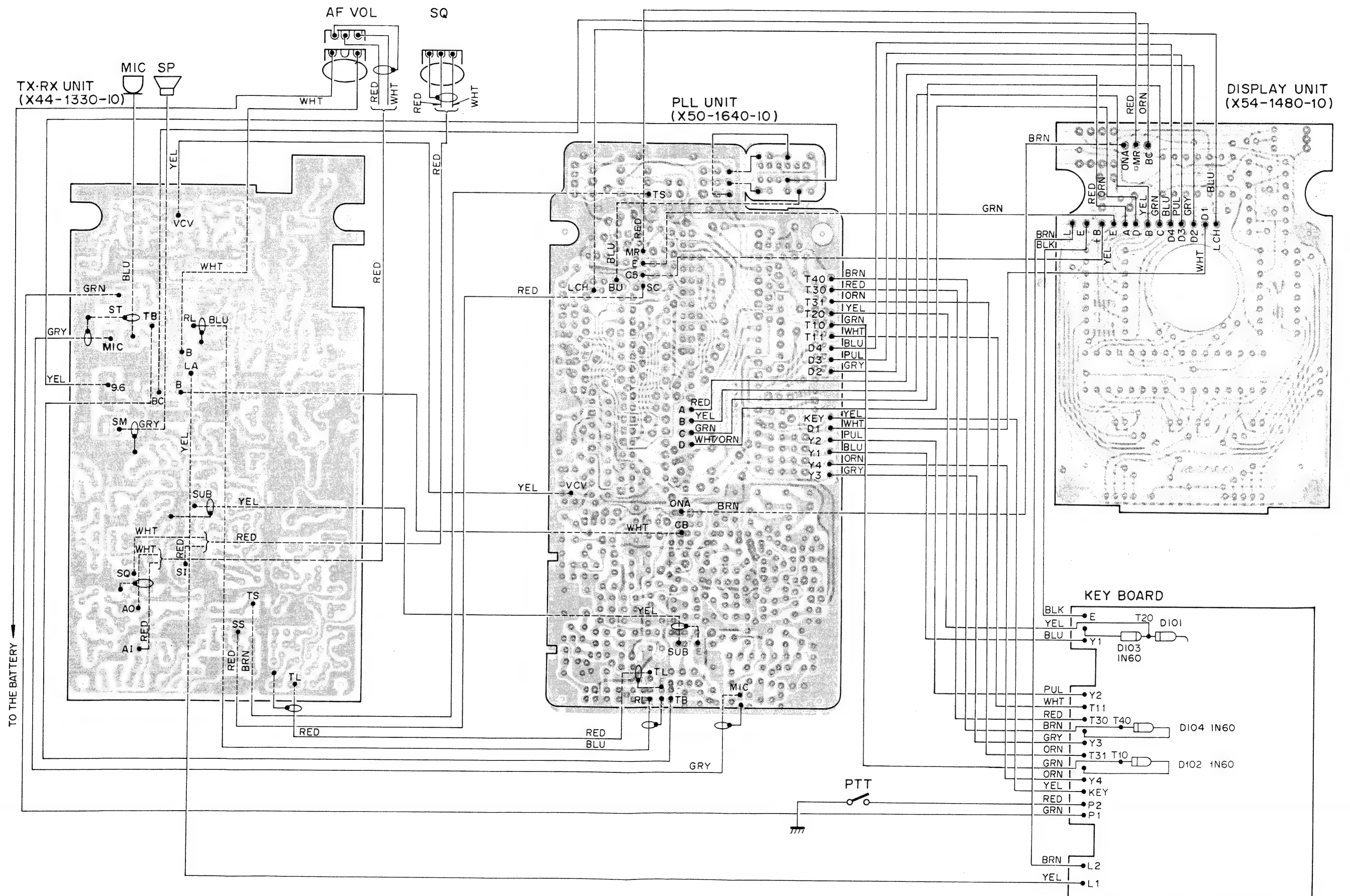
7. RX Unit Adjustment

- Connect the SSG (DEV: 5 kHz, MOD: 1 kHz) to the antenna terminal and a dummy load (8 ohms) to the EAR phone terminal. Connect an AF VTVM and oscilloscope across the audio output.
- Receive a signal at 145.980 MHz and connect an RF VTVM to TP3 in the TX-RX unit. Set the SSG output to about 10 dB (2 μ V) and adjust L1, L2, L4, L5, L6, L7 and L8 for maximum.
- Reduce the SSG output to -6 dB (.25 μ V) and adjust L1 and L2 for maximum AF output.
- Check that the S/N ratio in-band is better than 28 dB at 1 μ V input.
- With the transceiver set to an empty channel, adjust the squelch control to 9 o'clock and adjust VR1 for noise threshold.

PARTS LAYOUT/REF. DATA



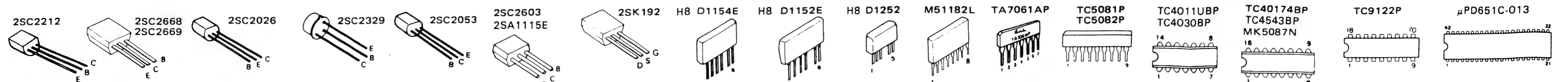
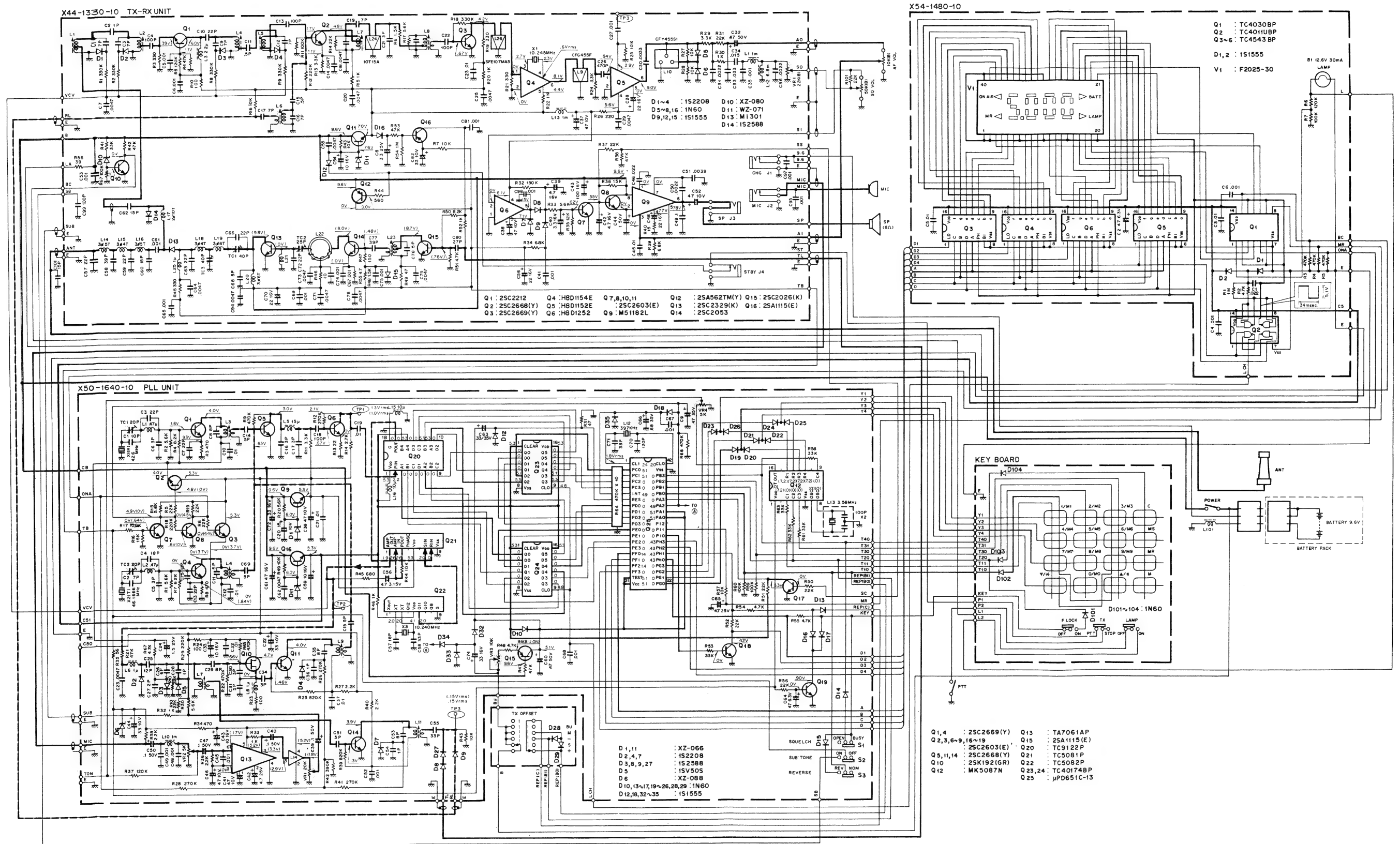
WIRING DIAGRAM (K type) from S/N 006XXXX~010XXXX



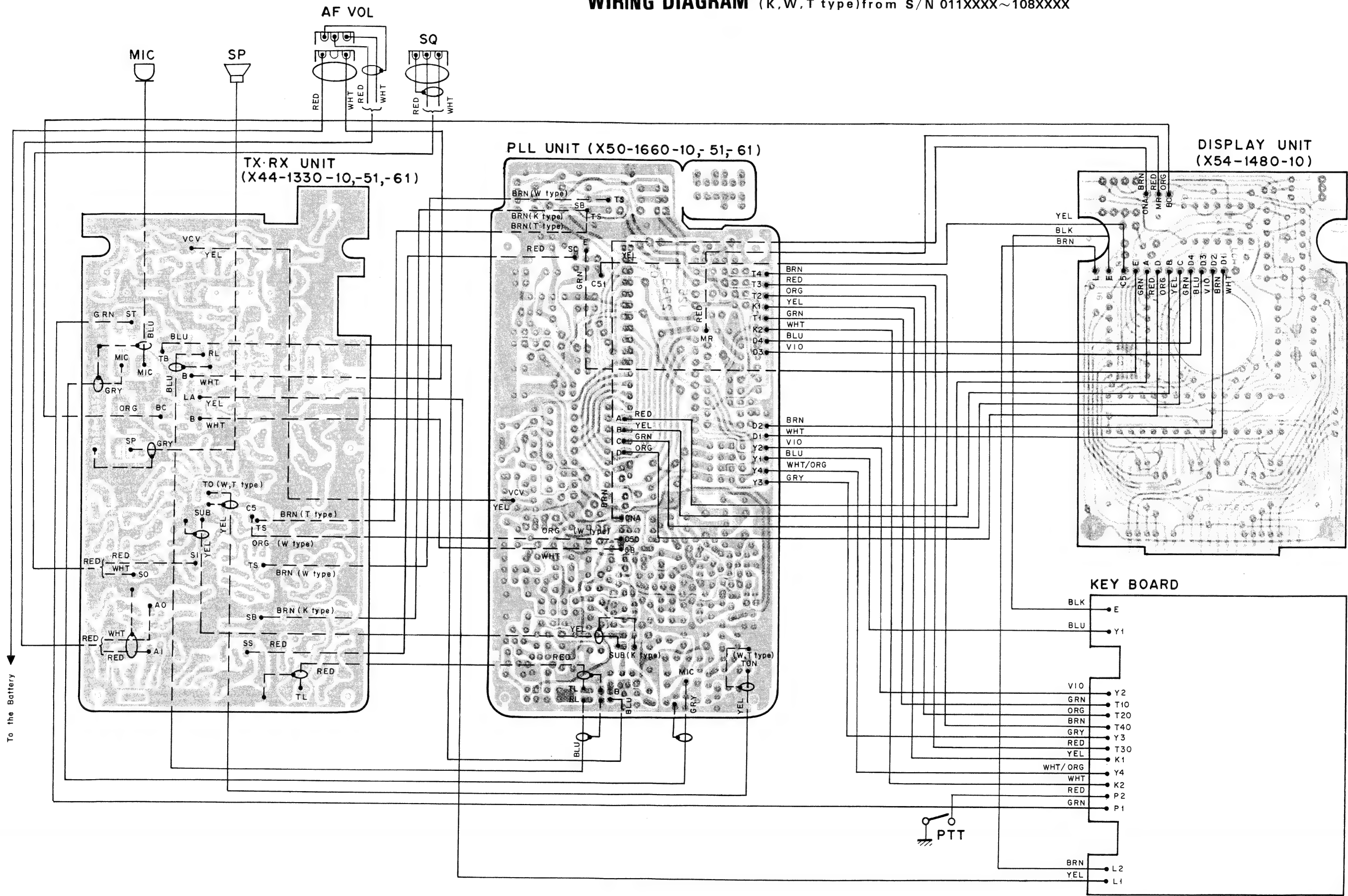
SCHEMATIC DIAGRAM (K type) from S/N 006XXXX ~ 010XXXX

Voltage measure condition.
 Power supply voltage: 9.6V
 MODE: S
 Frequency: 145.000 MHz
 Receive section: no input signal, squelch on.
 Transmitter section: 50Ω Load
 Transmitter voltage

— Signal line — OSC & Control line — B line — Adjusting point



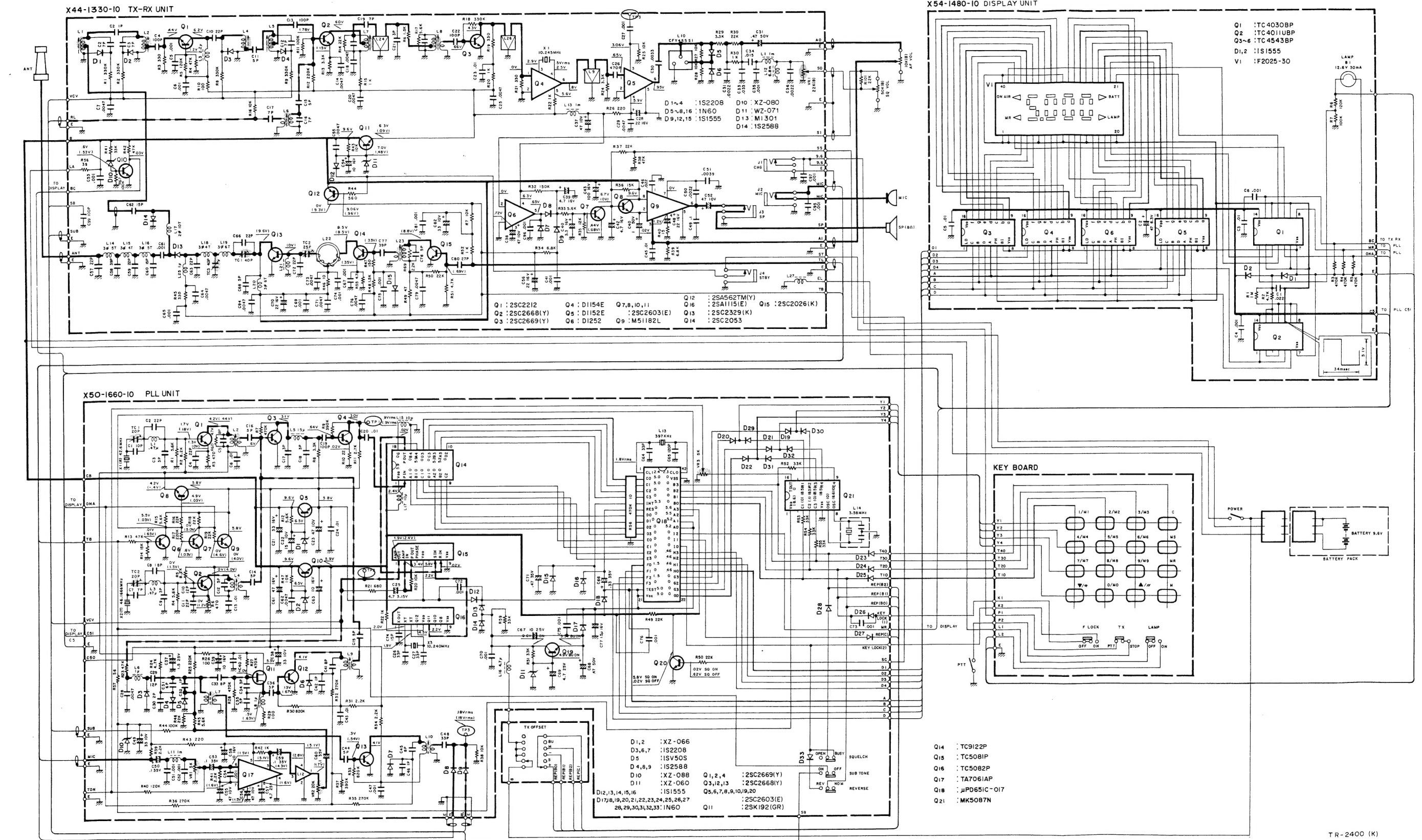
WIRING DIAGRAM (K,W,T type)from S/N 011XXXX~108XXXX



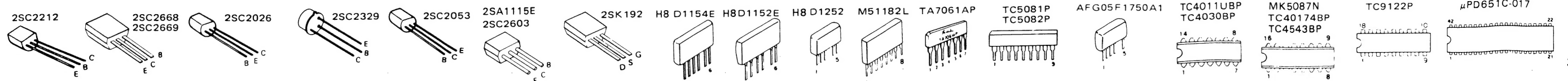
SCHEMATIC DIAGRAM (K type) from S/N 011XXXX~108XXXX

Voltage measure condition.
 Power supply voltage: 9.6V
 MODE: S
 Frequency: 145.000 MHz
 Receive section: no input signal, squelch on.
 Transmitter section: 50Ω Load
 Transmitter voltage

— Signal line ——— OSC & Control line — B line ● Adjusting point



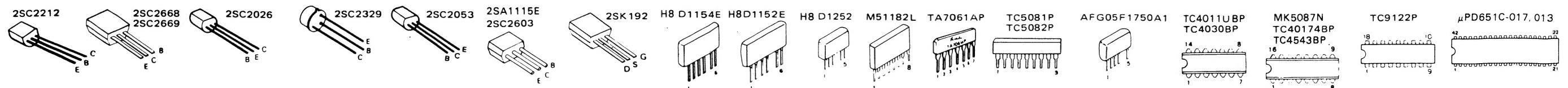
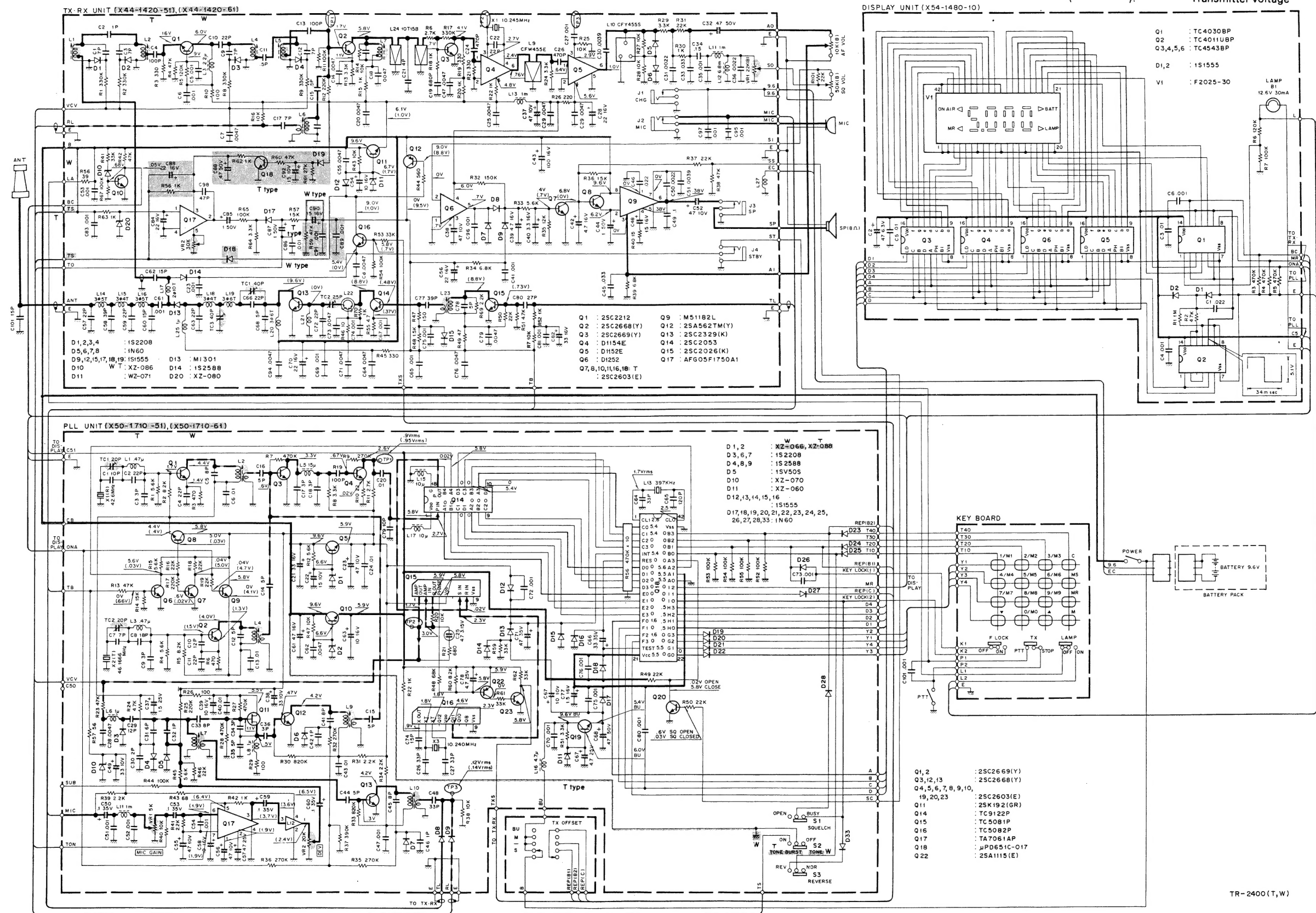
TR-2400 (K)



— Signal line - - - - - OSC & Control line — B line ● Adjusting point

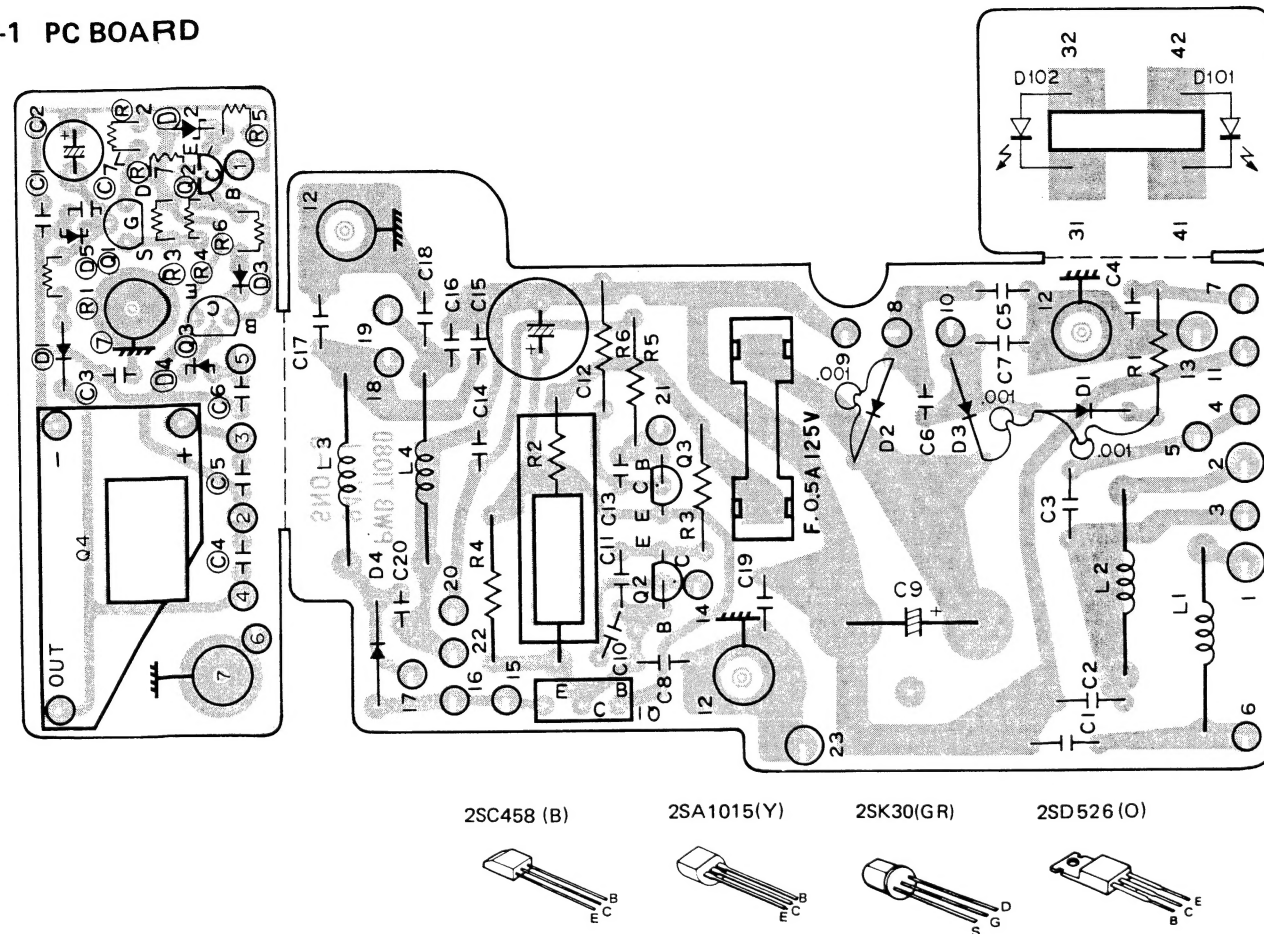
SCHEMATIC DIAGRAM (W, T type) from S/N 109XXXX

Voltage measure condition.
Power supply voltage: 9.6 V
MODE: S
Frequency: 145.000 MHz
Receive section: no input signal, squelch on.
Transmitter section: 50 Ω Load
(): Transmitter voltage

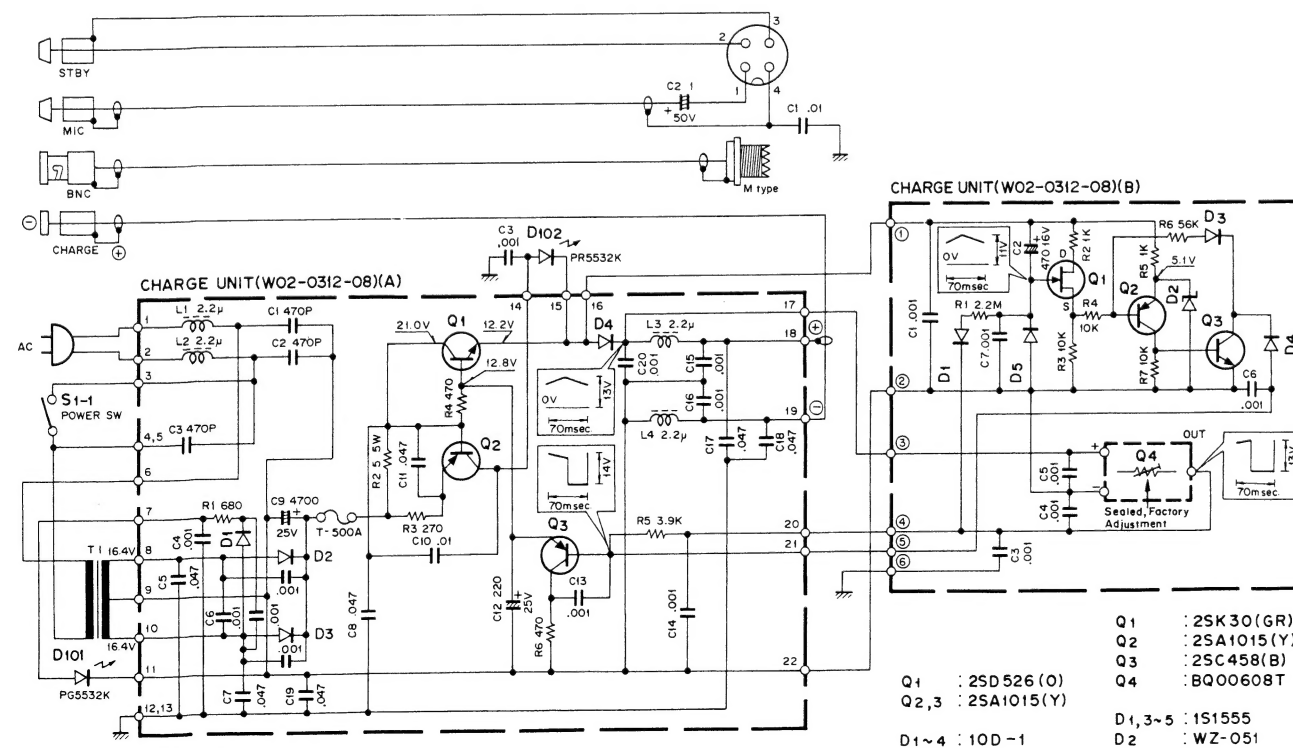


ST-1 BASE STAND

ST-1 PC BOARD



ST-1 SCHEMATIC DIAGRAM



BC-5/ST-1

BC-5 DC-DC CHARGER

SPECIFICATIONS

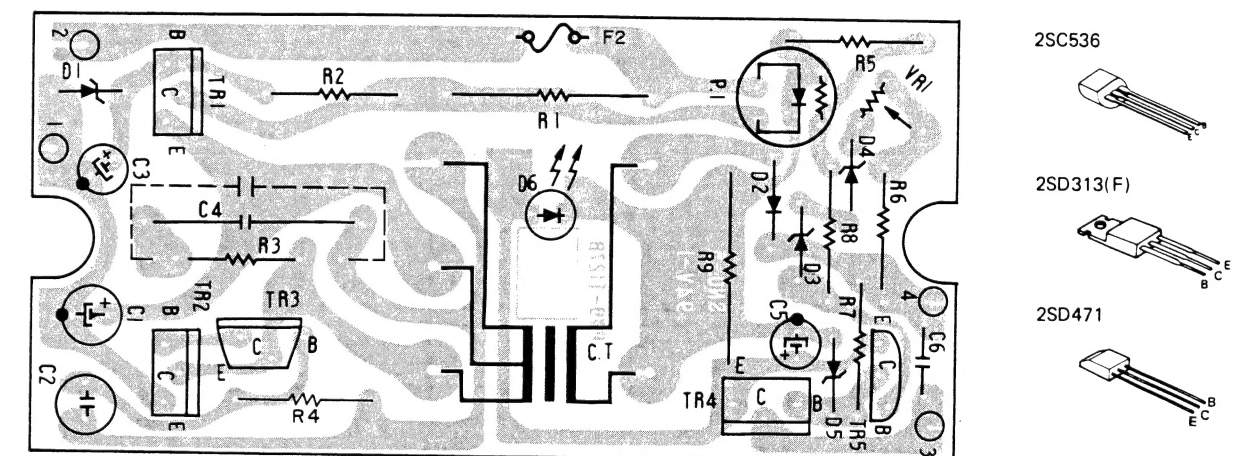
Input:	13.8V DC
Output:	11.6V DC, 250 mA
Operating input voltage:	13.8V DC \pm 15%
Charging characteristic:	The Ni-Cd Pack (8 "AA" type cells in series) can be charged over 70% within 2 hours at 25° \pm 3°C.
Operating temperature:	0°C to +45°C
Power consumption:	Less than 13W at 13.8V DC input, 250 mA load.
Weight:	Approximately 350g (0.77 lbs.)

ST-1 BASE STAND

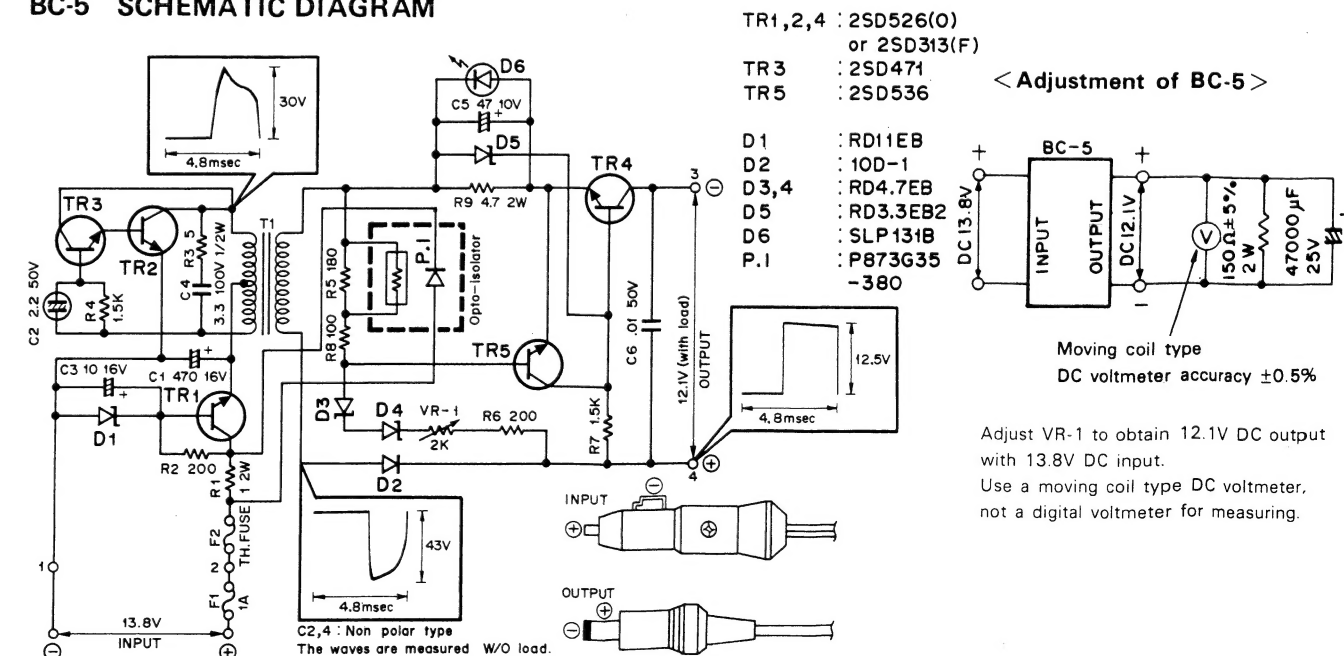
SPECIFICATIONS

Application:	Nickel cadmium (Ni-Cd) battery charger	
Charging current:	400 mA	
Operating temperature:	0°C to +45°C	
Power requirement:	120V AC 60 Hz, 220V, 240V AC 50/60 Hz	
	There are three versions of the ST-1, a 120V, a 220V and a 240V line model.	
	Each model is preset to the line voltage of the destination.	
Dimensions:	Wide	122 mm (4-13/16")
	High	82 mm (3-1/4")
	Deep	177 mm (7")
Weight:	1 kg (2.2 lbs.)	

BC-5 PC BOARD



BC-5 SCHEMATIC DIAGRAM



ST-1,BC-5,PB-24,SC-3 PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
ST-1 (BASE STAND) (K, T, W, X)			
—	A01-0770-23	Case (lower) (K)	☆
—	A01-0771-13	Case (lower) (T) (W) (X)	☆
—	A02-0609-01	Case (upper)	☆
—	A53-0303-04	Stopper (model name) (K) (W) (X)	☆
—	A53-0304-04	Stopper (model name) (T)	☆
—	B41-0614-04	Warning plate	☆
—	B46-0058-10	Warranty card (K)	☆
—	B50-2714-00	Operating manual	☆
—	E04-0152-05	UHF type receptacle	☆
—	E06-0453-05	4P Mic jack	☆
—	E30-0181-05	AC cord (K)	☆
—	E30-0185-05	AC cord (X)	☆
—	E30-0585-05	AC cord (W)	☆
—	E30-0602-05	AC cord (T)	☆
—	E30-1659-05	Mic plug cord	☆
—	E30-1660-05	BNC cord ass'y	☆
—	E30-1661-08	DC plug cord	☆
—	H01-2668-03	Carton (inside) (K) (W) (X)	☆
—	H01-2669-03	Carton (inside) (T)	☆
—	H12-0468-03	Cushion	☆
—	H25-0079-04	Protective bag 200 × 200	☆
—	H25-0106-04	Protective bag 250 × 350	☆
—	J02-0069-05	Foot × 4	☆
—	J41-0006-00	Cord bush AC (K)	☆
—	J41-0024-15	Cord bush AC (T) (W) (X)	☆
—	J41-0038-05	Cord bush Coax. Cable	☆
—	J42-0418-08	Cord bush MIC, DC	☆
T1	L01-8021-08	Transformer (K)	☆
T1	L01-8032-08	Transformer (W)	☆
T1	L01-8042-08	Transformer (T) (X)	☆
S1	S36-1402-05	Power switch	☆
D101	V11-7273-86	LED PG5532K	☆
D102	V11-7272-36	LED PR5532K	☆
—	W02-0313-08	Charge unit	☆
Charge Unit (W02-0312-08) (Block A)			
—	F05-5016-05	Fuse 0.5A × 2 (slow blow)	☆
—	J13-0406-08	Fuse holder	☆
L1~4	L33-0601-05	Choke coil 2.2mH	☆
Q1	V04-0526-30	Tr 2SD526(O)	☆
Q2,3	V01-1015-06	Tr 2SA1015(Y)	☆
D1~4	V11-0159-05	Diode 10D-1	☆
Charge Unit (W02-0312-08) (Block B)			
D1	V11-0076-05	Diode 1S1555	☆
D2	V11-4103-60	Diode XZ-051(Sub. of WZ-051)	☆
D3~5	V11-0076-05	Diode 1S1555	☆
Q1	V09-0016-05	FET 2SK30 (GR)	☆
Q2	V01-1015-06	Tr 2SA1015 (Y)	☆
Q3	V03-0093-05	Tr 2SC458 (B)	☆
Q4	W02-0312-05	Module BQ00608T	☆

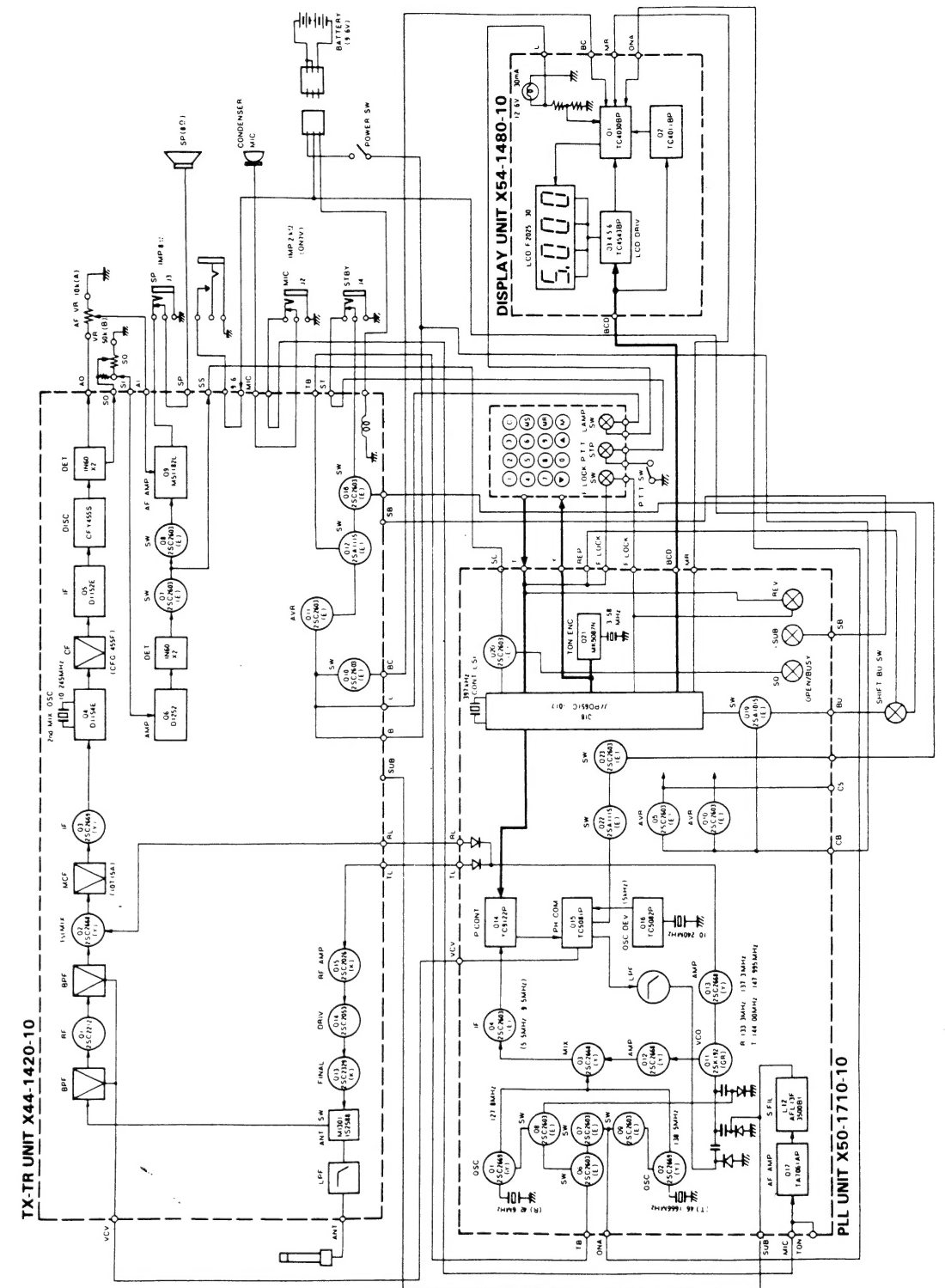
Ref. No.	Parts No.	Description	Re- marks
BC-5(K,T,W,X)			
—	A02-0610-08	Case	☆
C3	C91-0468-05	Metalized film cap. 3.3 μF 100V	☆
—	E30-1663-03	Input cord with plug	☆
—	E30-1664-03	Output cord with plug	☆
F2	F09-0407-08	Thermal fuse 98°C 125V 3A	☆
—	H01-2670-08	Carton (inside) (K) (W) (X)	☆
—	H01-2671-08	Carton (inside) (T)	☆
—	L19-0322-08	Transformer	☆
—	N09-0621-08	Screw × 2 3 × 42mm	☆
—	N10-2030-45	Nut × 2	☆
—	W02-0314-08	Charge module	☆
Charge Module(W02-0314-08)			
D1	V11-4474-06	Zenner diode RD11EB	☆
D2	V11-0159-05	Diode 10D-1	☆
D3,4	V11-4473-96	Zener diode RD4.7EB	☆
D5	V99-7770-26	Zenner diode RD3.3EB2	☆
D6	V11-6174-16	LED SLP-131B	☆
P.I	V11-7774-26	Opto-isolator P873G35-380	☆
TR1,2,4	V04-0526-30	Tr 2SD526(O) or	☆
	V04-0313-16	2SD313(F)	
TR3	V04-0471-00	Tr 2SD471	☆
TR5	V03-0339-05	Tr 2SC536	☆
PB-24			
—	E31-2046-05	Cable with connector for W09-0306-05	☆
—	E03-0203-05	DC jack for charging cord ass'y	☆
—	E30-1658-04	Charging cord ass'y	☆
—	W09-0306-05	Ni-Cd battery unit	☆
SC-3(T,W,X)			
—	J19-1333-03	Clip	☆
—	J32-0742-04	Boss C (BAND)	☆
—	J32-0743-04	Boss D (BAND)	☆
—	J32-0744-04	Clip boss × 2	☆

PB-24 Ni-Cd Rechargeable Battery

SPECIFICATIONS

Voltage:	9.6V
Capacity:	450 mAh/90 mA
Normal charge:	45 mA × 15 hrs.
Continuous charge:	9 mA ~ 22.5 mA
Nominal discharge:	90 mA
Maximum continuous discharge:	900 mA
Minimum pack voltage for charging:	8.4V

BLOCK DIAGRAM (K type) from S/N 109XXXX~



A product of
TRIO-KENWOOD CORPORATION
 17-5, 2-chome, shibuya, shibuya-ku Tokyo 150, Japan

TRIO-KENWOOD COMMUNICATIONS
 1111 West Walnut Street, Compton, California 90220, U.S.A.
TRIO-KENWOOD COMMUNICATIONS, GmbH
 D-6374 Steinbach TS, Industriestrasse 8A, West Germany
TRIO-KENWOOD ELECTRONICS, N.V.
 Leuvensesteenweg 504, B-1930 Zaventem, Belgium
TRIO-KENWOOD (AUSTRALIA) PTY. LTD.
 4E Woodcock Place, Lane Cove N.S.W. 2066, Australia